CITY OF
BAINBRIDGE ISLAND

The Environmental Technical Advisory Committee will hold this meeting in person, in the City Hall Chamber Conference Room, 280 Madison Ave N, Bainbridge Island, WA.
It is recommended that attendance be in person, but it is also accessible via the Zoom meeting platform.

Please click this URL to join. https://bainbridgewa.zoom.us/j/87040273950
Description: Environmental Technical Advisory Committee Regular Meeting
Or One tap mobile:
+12532050468,,87040273950# US
+12532158782,,87040273950# US (Tacoma)

Agenda for October 19, 2023, ETAC Regular Meeting

Call to Order

Roll Call / Conflict of Interest Disclosure

Members: Dylan Frazer Ben Harrison Melanie Keenan Malcolm Gander Brian Harmon

Council Liaison: Jon Quitslund

COBI Staff: Daria Hansen – Public Records Analyst

Approval of Agenda – October 19, 2023

Approval of Minutes – August 17, 2023 and September 21, 2023 (5 min)

Council Liaison Report – Jon Quitslund (10 min)

Chair Report – Melanie Keenan will lead discussion (10-15 min)

Update on Groundwater Management Plan (GWMP) - All **(35** min)

- Report on GWMP Subcommittee Meeting of 9/25/23 (Keenan)
- Link to meeting recording

https://bainbridgewa.gov/AgendaCenter/Groundwater-Management-Plan-GWMP-Working-61/?#_09252023-1893

- Discussion of Documented Seawater Intrusion Occurrences
    - New well data (separate well log files) from WA DOE: 6600 NE Seabold Rd (Nezam T.); and Seabold Community Water System
    - Connate water, or seawater intrusion; connate H2O may require its own EWL/management
    - RE: Connate H2O: ID what parameters (e.g., electrical conductivity) can help distinguish seawater from connate water
    - February 2007 Bainbridge Review article on Seawater Intrusion (separate file) as impetus for 2011 USGS Modeling Report
    - Dick Krutch September 22, 2023 Bainbridge Review letter on shallow aquifer wellfield (separate file)
- Historic Bainbridge Island aerial photos possibly available through committee members Harrison, and Keenan link to recharge areas.
- Excerpt (separate file) from USGS 2011 BI Groundwater Model: Only slightly more than 5% of groundwater recharge from off-island to BI occurs
- Request Public Works Director to update ETAC on GWMP **Update on UAC meeting**- All **(**10 min)
- COBI Workshop September 28-October 29 Online Public Feedback. ETAC input for Kick- Off meeting.
  Sept. 28 - Oct. 29 (Participate on your own time online with a virtual workshop and public feedback)
- **FYI: For November ETAC Meeting: Sections to review regarding current Comprehensive Plan**
    - COBI Website, links to 2016 Elements https://www.bainbridgewa.gov/162/Comprehensive-Plan
    - Land Use Element
    - Environmental Element
    - Water Resource Element (attached below)
    - https://www.bainbridgewa.gov/DocumentCenter/View/7801/6-WATER-RESOURCES?bidId=
    - Utilities Element

Discussion of selection of new ETAC Chair – All (10 min)

Discussion of queries to new potential ETAC members and COBI tools to aid ETAC in reaching out to the public (All 5 min)

Other topics of interest – All (10 min)

Public Comment (5 min)

Adjournment – 5:00 p.m.

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Environmental Technical Advisory Committee
Regular Meeting Minutes
Thursday, August 17, 2023
City Hall Chamber Conference Room

Call to Order (Attendance, Agenda, Conflicts of Interest)
Approval of Meeting Minutes from July 20, 2023
Council Liaison Report
Chair Report
COBI Staff Comments
- **Discussion and update on the GWMP**
- **Discussion of historic BI aerial photographs**
- **Discussion of San Juan County New Construction Ordinance**
- **Discussion of selection of new ETAC chairperson**
- **Discussion of public outreach for new ETAC members**

Call for Public Comment
Adjournment

Members Present:
Malcolm Gander, Brian Harmon, and Melanie Keenan attended in person. Dylan Frazer participated via Zoom.

Members Absent:
Ben Harrison was absent and excused.
(4 vacant positions)

COBI Staff and City Council Present:
Patty Charnas (Director, Planning & Community Development), Jon Quitslund (Council Liaison), Daria Hansen (Public Records Analyst).

Meeting called to order at: 3:01 p.m. There were no conflicts of interest disclosed.

Approval of July 20, 2023, Agenda:
Motion: I move to approve the August 17, 2023, meeting agenda as presented.
Gander/Keenan: Passed unanimously

Review & Approve Minutes – July 20, 2023
Motion: I move to approve the July 20, 2023, minutes, with minor edits to wording for clarity.
Gander/Keenan: Passed Unanimously

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Environmental Technical Advisory Committee
Regular Meeting Minutes
Thursday, August 17, 2023
City Hall Chamber Conference Room

Council Liaison Report (Jon Quitslund):
The Shoreline Master Plan is scheduled to be discussed by Council at the September 26th meeting. There will also be an action on ETAC appointments at this meeting, if there are any people interested in joining.
The Council discussed a presentation by Chris Wierzbicki on the consultant's model predictions for the GWMP.

Chair Report (Melanie Keenan):
Wanted to discuss the aerial photographs of the Island, but as Ben isn't present, this will be put off until he can participate and share his information.

COBI Staff Comments:
None.

Discussion/update on the Groundwater Management Plan:
Melanie brought up her concerns on the information presented by Chris Wierzbicki in the GWMP report at the August 15th Council Study Session. An extensive discussion followed pertaining to the need for public commentary, participation and education on groundwater issues, the data used by Aspect to run their model and future predictions on water availability on Bainbridge, the need to include currently known data in models for accuracy in predicted scenarios, production wells and private wells and concerns with known and modeled future seawater contamination, and the draw-down, mining out and reconditioning of wells. Melanie emphasized the need for proper language and professional integrity when presenting information to the public.

Melanie mentioned that the current early warning system for high chloride levels, sea level intrusion and draw-down of wells, needs to be updated. She will share a previously created document regarding decommissioned wells around Eagle Harbor with Chris Wierzbicki. Discussion followed.

Melanie reiterated the idea that it would be helpful for the GWMP working group to periodically meet with the consultant to keep the process continually moving forward, as well as to keep the public regularly informed as the plan develops. How to involve all the stakeholders in this process? Discussion followed. Jon will bring concerns to the City Manager.

Discussion on how the GWMP fits in with the Comprehensive Plan, combining aquifer recharge zones, climate change impacts with watershed and surface water monitoring and the necessity of proper planning.

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Melanie volunteered to educate the Council on water issues and suggested regular short seminars to educate the public about aspects of the GWMP and how it is progressing. There could be discussions and slide show presentations; hydrogeology 101. Jon suggested utilizing the open-mic sessions put on by Charlie, as the best way to educate both the Council and the public on these issues. The city webpage also needs to be updated and used as an outreach tool. Dylan emphasized the need to stick to the current fact sheet to maintain consistency and avoid confusion.

Discussion of historic BI aerial photographs:
Waiting for Ben to be present to discuss.

Discussion of San Juan County New Construction Ordinance:
Malcolm explained the San Juan County Ordinance developed to address water usage with regards to new construction and suggested that something similar be adopted as a possible planning tool within the GWMP. Data estimates of current water use on Bainbridge Island are around 900 million gallons per year. How best to measure and manage water use going forward? Discussion followed.

Discussion of selection of new ETAC chairperson:
This topic was put off until Ben could be present. For now, Melanie will act as temporary chairperson and will prepare the meeting agendas.

Discussion of public outreach for new ETAC members:
Can we have city staff or volunteers keep up on the website? Discussion followed.

Public Comment:
None.

Adjournment- 4:20 p.m.

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Environmental Technical Advisory Committee
Regular Meeting Minutes
Thursday, September 21, 2023
City Hall Chamber Conference Room

Call to Order (Attendance, Agenda, Ethics)
Approval of Meeting Minutes from May 18, 2023
Council Liaison Report
Chair Report
COBI Staff Comments
Update on Groundwater Management Plan (GWMP) & discussion
Update on UAC Meeting
Update on Comprehensive Plan & discussion
Discussion of Selection of new ETAC Chair
Other Topics of Interest
Adjournment

Committee Members Present:
Melanie Keenan, Malcolm Gander, Benjamin Harrison. Dylan Frazer attended via Zoom.
Members Absent & Excused: Brian Harmon
(4 vacant positions)

COBI Staff and City Council Present:
Patty Charnas (Director, Planning & Community Development), Jon Quitslund (Council Liaison), Daria Hansen (Public Records Analyst)

Meeting called to order at: 3:08 p.m.

Approval of September 21, 2023, Agenda:

> **Motion:** I move to approve the September 21, 2023, agenda as presented.
> **Gander/Harrison:** Approved unanimously

Review & Approve Minutes from August 17, 2023, meeting:
Melanie asked for more time to review the minutes; no motion was made. The August minutes will be approved at the October 19th meeting.

Council Liaison Report (Jon Quitslund):

Jon briefly mentioned the upcoming open house for the Comprehensive Plan, next Wednesday at 4:30, with workshops from 6-8 p.m., and the upcoming presentation to Council by the Steering Committee on Tuesday night.

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Chair Report (Melanie Keenan)**:**

Melanie summarized the UAC meeting and Chris Wierzbicki's update on the GWMP and her thoughts on water sourcing for Lynwood Center, types of aquifers and wells. Discussion followed. Malcolm and Melanie are meeting on Monday with Chris W. and the consultant, as GWMP subcommittee representatives.

Discussion followed regarding groundwater concerns, climate change and recharge concerns, and how best to plan for population growth and water sustainability. Melanie and Malcolm have requested data and scope for work used to compile the Aspect report.

Melanie suggested the committee members re-read the Water Resources element and to review the city's shortcomings and issues for sustainability.

Malcolm reviewed the San Juan County ordinance brought up at the last meeting. Discussion followed on how ETAC is supposed to be collecting data on how growth, development, sea level rise, and climate change are impacting water resources. There currently aren't reasonable metrics on how a development will impact water at a site. Important to collect data for high density development-where is the water coming from? Which wells will that area rely on? What is the planned water use? Melanie wants to research how other communities are getting metrics for these issues so ETAC can monitor them, report on them, and have some meaningful planning going forward.

It would be good if ETAC could be involved when the Council was updated by Chris W. so they can stay current and provide feedback.

Update on Groundwater Management Plan (GWMP) and discussion of-

The committee reviewed the Aspect April 19, 2023, GW Model Update memo and previously submitted comments from Charlie Kratzer.

Malcolm reviewed some specific notes highlighted in the memo and summarized issues of concern regarding the aquifer system. Clarity is needed on Aspect's models and determinations.

Committee members need to review this document on their own, in full, and bring concerns to the consultant when a finalized draft is completed. The wording of the report is problematic. Important for

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GWMP and ETAC input to get into the conversation. Discussion followed about stream-flow elements in relation to sustainability.

Update on UAC meeting-

Included in the Chair report.

Update on Comprehensive Plan and discussion /COBI Staff Comments:

Patty Charnas spoke about the history, process, and necessity of updating the Comprehensive Plan. She reviewed how under State law, the city is required to do a periodic update on the Comprehensive Plan that guides city services and decisions, housing, land-use, etc.

She mentioned the mailing sent out for public outreach to get public participation in meetings and discussed the venue for the upcoming workshops and presentations, the importance of determining policy gaps between existing and adopted plans, climate change and resiliency, and city codes and capital facilities.

Patty also discussed the Steering Committee that will be overseeing the Comprehensive Plan development and topics to be presented to and discussed with Council on Tuesday night. Patty answered questions from committee members. A discussion followed on water and utilities, the role of KPUD in the planning process, and the data and information they can provide, and how the GWMP can help to guide the Comprehensive Plan.

How many other cities in WA have comprehensive plans? Discussion followed on the Puget Sound Regional Council, obligations to address climate and equity, issues of concern, such as transportation and housing, County and city planning policies, and how the Bainbridge Island Comprehensive Plan relates to the Kitsap County planning process.

Water Resource Element of Comprehensive Plan-

Melanie explained her concerns with putting private wells on bigger water systems, about the 5 aquifers on Bainbridge, and the limitations of bedrock to serve a large water system. She emphasized the need to balance water use between shallow perch aquifers and deep aquifers.

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Melanie will discuss her questions with Chris W. regarding the importance of monitoring private wells and how current monitoring data was reflected in the Aspect update.

Discussion of selection of new ETAC Chair –

Melanie will continue to act as the ETAC Chair, with Malcolm acting as Vice Chair and Ben being a backup. As more members join ETAC, the question will be brought up again for discussion.

Other topics of interest-

Ben informed the committee about an upcoming Salmon Recovery Board meeting in December and discussed the process and how the impacts from their decisions will impact Bainbridge Island streams and wells. He suggested ETAC keep an eye on how things will proceed in relation to the GWMP.

Patty brought up a formerly discussed issue regarding Kitsap County's wetland mitigation bank through the Department of Ecology. She reached out to them and expressed the desire to add multiple streams and shoreline areas to the bank and was told that the current map is only the beginning of their process. Patty will provide a copy of the current map to the committee members. Discussion followed.

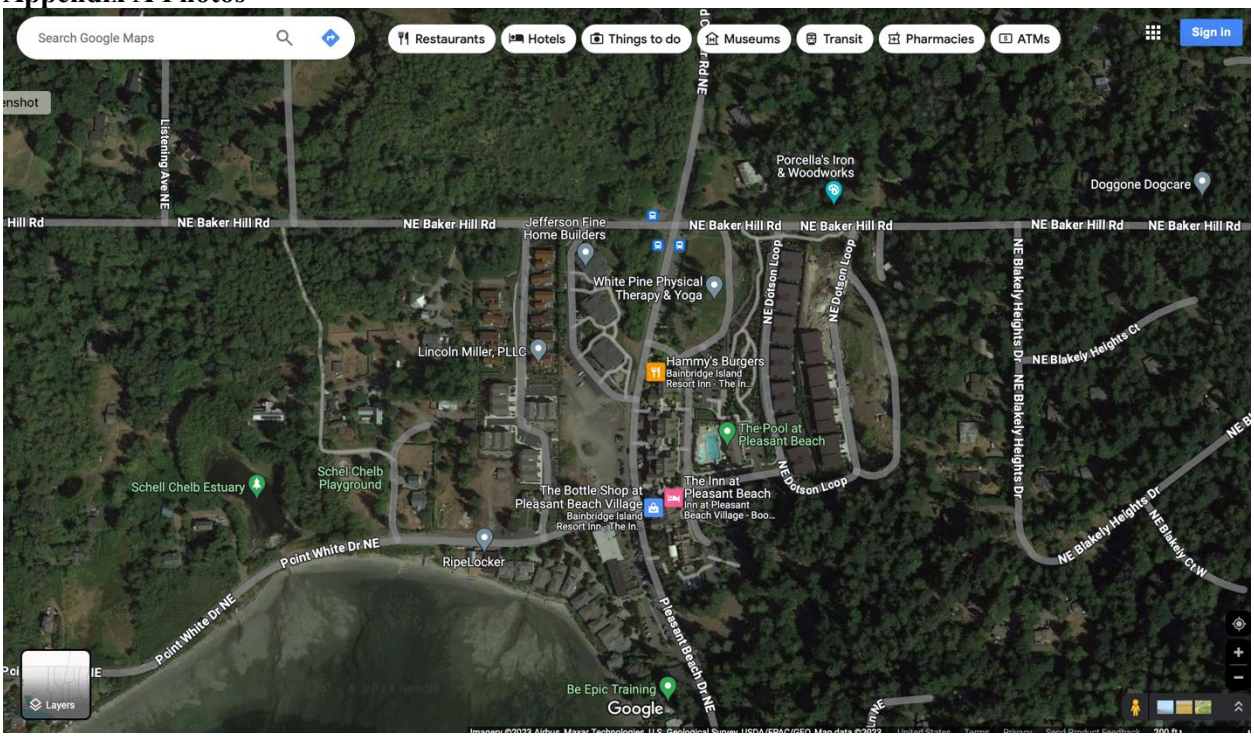
The first Open-Mic Science had its first meeting at the Treehouse and will continue to be held on the second Tuesday of each month. Ben briefly mentioned upcoming topics.

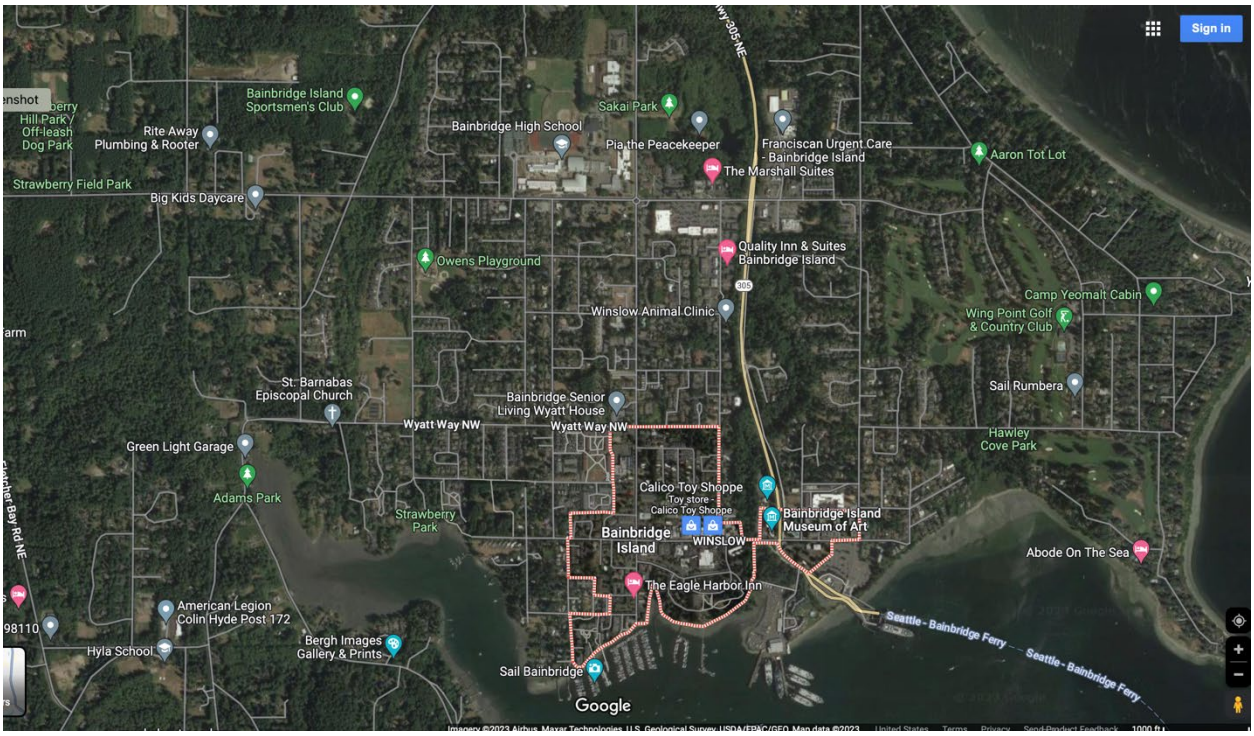
Malcolm and Ben will create a sub-committee to further research aerial photos of Bainbridge Island to illustrate changes to development, deforestation, and aquifer recharge areas. Jon suggested they contact Land Trust Mapping. Ben will present more information at the October meeting.

Public Comment- None

Adjournment – Acting committee chair, Melanie Keenan, adjourned the meeting at 4:40 p.m.

Appendix A Photos





Other areas we should consider

Appendix B High Chloride/Seawater Intrusion History Memo, 2 News Articles, Well Logs

Appendix C USGS Conceptual Model and Numerical Simulation of the Groundwater-Flow System of Bainbridge Island, Washington, 2011, see abstract, and p. 68.
"Groundwater inflow to the Island accounts for about 1000 acre-ft/yr or slightly more than 5% of the recharge amount."

Appendix D: February 28, 2017 Comprehensive Plan Water Resources Element

Appendix B

COBI GWMP Notes

June 13, 2022; **Revised October 12, 2023**

Historic Documentation for Seawater Intrusion on BI, Early Warning Levels
Melanie Keenan, Malcolm Gander

Historic References Containing Well Names Exhibiting Elevated Chloride/Seawater Intrusion

1) 1957 Geological Survey Water-Supply Paper 1413; 2 wells on either side of Eagle Harbor, p.56
https://doi.org/10.3133/wsp1413

2) 1988 USGS Water-Resources Investigative Report 87-4237; 2 wells, p.45
https://pubs.usgs.gov/wri/1987/4237/report.pdf

3) October 30, 2006 Baseline Groundwater Technical Information Summary-Aspect; many coastal and inland wells, pgs, 7-10. Over 10 wells with reported chloride
Part 1 https://www.bainbridgewa.gov/DocumentCenter/View/266/Baseline-Groundwater-Technical-Information-Summary-1-Part-1?bidId=

Part 2 https://www.bainbridgewa.gov/DocumentCenter/View/267/Baseline-Groundwater-Technical-Information-Summary-1-Part-2?bidId=
Note:

Data from this October 30, 2006 document is summarized in the following table:

Table 1. 1989 – 2002 Historical chloride concentrations (Aspect, 2006)

Well Name	Well ID	Max Chloride (mg/L)	# of Times Well Was Tested For Chloride
Samson Water System	34L06	424 1993 to <5 in 2004	Multiple times – last sampled 2004
Little Manzanita Water	09F01	93.9	More than once; exact number unknown
Meadowmeer Well 2	16A04	120.5	More than once; exact number unknown
Islandwood Estates	16E04	96	More than once; exact number unknown
Unnamed	15P05	50	Once
Clark Acres Water	20G04	68	Once
Fletcher Bay Well	20K04	47.6	More than once; exact number unknown
Private	23K04	86.1	Once
Bainbridge Green	27F03	42	Once
Private	27L06	351	Once
Unnamed	28P01	110	Once
Private	35E06	111	Once
Seabold Water System (not shown in figure)		419	Multiple times 1998-2006

4) March 2009 (Revised) Groundwater Monitoring Program Bainbridge Island December 2008; 9 coastal wells and 2 inland wells, p 10. plus more.
https://www.bainbridgewa.gov/DocumentCenter/View/2622/Groundwater-MonitoringProgram_Update_2009_Part1?bidId=

5) May 2018 Seabold Potential Seawater Intrusion Investigation May, COBI+KPUD+KPHD; twelve wells in the Seabold area
https://www.bainbridgewa.gov/DocumentwCenter/View/10662/Seabold-Final-Report (this link will work if copied and patched into a browser)

PHASE I
" In 2006, chloride concentration in the Seabold Water Association drinking water supply well

exceeded the city's early warning level for potential seawater intrusion... Wells targeted for the assessment were those with a static water level elevation at or near sea level and a well screen interval in the Sea Level Aquifer or a similar shallow aquifer located at depth of seas level to about 100 feet. (Are all the historic problem wells in the area documented?)...
...KPUD staff completed an assessment of data on file with the Health District and its own in – house database (APSFED) to examine records for private and public supply bells, both active and inactive that met the construction criteria and chloride analyses. About 230 wells had at least one chloride values in APSFED. Of those, less than 5 met the criteria, and none had unusual chloride values...
PHASE 2
...During Phase 2, city staff measured well water chemistry in eleven representative public and private well in the local vicinity of the Seabold Water Association well (Figure 1). Though one well (26/2E-29Q) initially exceeded the EWL, subsequent confirmation sampling did not exceed the Early Warning Level (EWL). The city intends to add this well to its routine annual chloride monitoring for future observation...
...The city also monitored the Seabold Community Water System Well. Although this well is no longer in use, chloride concentration in this well remains high and has increased since sampling 2006...However it is unlikely that seawater intrusion is the source of these results based on the following:... **Although seawater intrusion of the Seabold well is unlikely, it cannot be completely ruled out... If chloride concentrations decline with time, it may be evidence that historic pumping of the well caused seawater intrusion..."** Attached is a separate file that contains the well log from the Seabold Community Water System well; on the left side of the one page log form is a line item entitled "Type of Water?" The entry for this line item reads "Salt Water." Also attached is a pdf file from a February, 2007 Bainbridge Review newspaper article where residents document widespread seawater intrusion as evidenced by tapwater in the water system well.

Does this reporting include all historic documentation and citizen reports for elevated chloride levels? Did all private well owners report chloride readings for KPUD assessment of Health Districts and in-house database to examine records for private and public supply wells both active and inactive? Many private well owners might not report out of concern for impacts to their property values.

Because a well is no longer available to sample at the time of study, and likely decommissioned in accordance with Health Dept. regulations, does not equate to an absence of concern in the area. Possible attempts should be made to collect additional information to document in the GWMP, and develop areas of concern recommended for future priority Seawater/Chloride monitoring. Have not seen more recent reporting on this area. Good reason to update EWL criteria, cannot sample decommissioned wells to prove increase or decrease of chloride levels.

6) SEABOLD AREA Nezam Tooloee former COBI City Council, during public meeting discussed elevated chloride level problems in his private well at 6600 NE Seabold Road. Talked about numerous attempts to address the problem, eventually drilled a 649-foot deep well in July 2006 into the Fletcher Bay Aquifer (FBA) for drinking water. In November 2006, the well was deepened to 1,015 feet and only high chloride groundwater was produced from the screened interval at 973 – 995 feet. In /February 2007, this well was decommissioned (taken out of service

by backfilling with pea gravel and bentonite). Three well logs verifying: a) the initial drilling of the 649-foot well; b) deepening of the well to 1,015; and c) decommissioning of the well are attached as separate pdf files. Also attached is a pdf file from a February, 2007 Bainbridge Review newspaper article where N. Tooloee notes seawater intrusion in his private well.

7) SEABOLD AREA M. Keenan personal communications while canvassing for City Council seat, talked with several Seabold homeowners upset about the poor quality, high chloride levels in their wells. Numerous costly attempts to address the problems. One owner sold her house and relocated on BI because she could no longer afford to deal with the high chloride levels and cost of drilling new wells.

8) CRYSTAL SPRINGS Sarah Blossom form COBI City Council, her family owned South Bainbridge Water, now KPUD, personal communication about Crystal Springs property owner irrigated his new landscape with his private well water and it died due to high chloride levels. Sarah related information to the homeowner but he used the well anyway.

9) PORT MADISON EAST SIDE 305, M. Keenan personal communication with homeowner, private well poor water quality (chloride?) and well went dry almost every summer.

10) Documented in newspaper and M. Keenan personal communication with homeowner, had to redrill his well several times to access drinking water. His well would go dry repeatedly whenever another new home was built near his property with another private well.

Document Excerpts

1) 1957

In Kitsap County, only two cases of salt-water contamination were noted. Those occurred in wells 25/2–26P2 and 25/2–35G1, on opposite sides of Eagle Harbor on Bainbridge Island. Vigilance is required in all large longshore ground-water developments to prevent further contamination, however.

WATER LEVELS

In most places in the county, the depth to water in wells is within 100 feet of the land surface at the well. Figure 20 is a graph on which

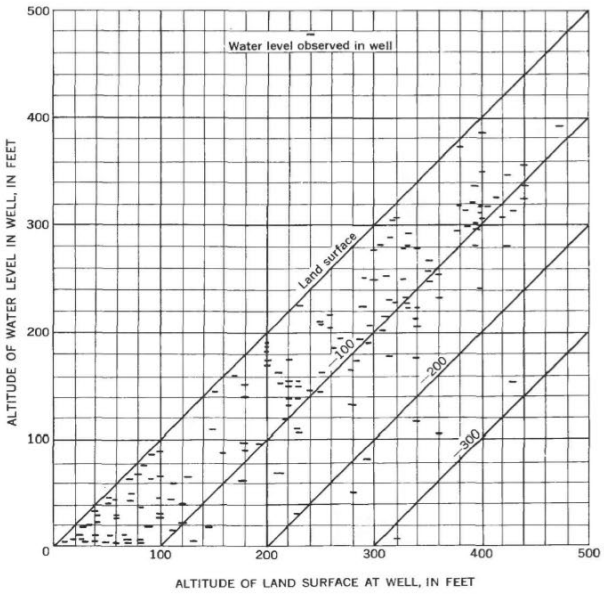


FIGURE 20.—Graph showing relation of water levels in the deeper wells (100 ft.+) to altitudes of land surface at the wells. Diagonal lines represent planes of equal depth below land surface.

known and reported water levels in nonflowing wells more than 100 feet deep have been plotted in respect to the altitude of land surface at the well. This figure shows that most of the water levels are between 50 and 100 feet in depth. Wells having greater depths to water are generally located near deep gullies or steep slopes to Puget Sound

---

3

2) 1988 USGS Water-Resources Investigative Report 87-4237; 2 wells, pgs.45

Despite these conditions and expectations, all 210 wells sampled in September 1985 had chloride concentrations of no more than 50 mg/L (table 8) and 95 percent had concentrations less than 11 mg/L (fig. 20). The largest concentration observed (50 mg/L) was from well 24/2E-14B02. This unused, dug well is situated near South Beach at the extreme southern tip of the island. Like well 25/2E-14P02 discussed earlier, the chloride concentration observed in September may have been temporary and influenced by tidal action. Indeed, the chloride concentration in well 24/2E-14B02 in April was only 16 mg/L. As shown in table 5, wells finished below sea level actually had smaller chloride concentrations in both April and September than wells finished above sea level, and the median concentration in all wells was unchanged from April to September. Had the average seasonal decline in water levels in 1985 been larger, as would be expected in a year of normal precipitation, chloride concentrations in September might have been somewhat larger. The amount of increase, however, would most likely be insignificant.

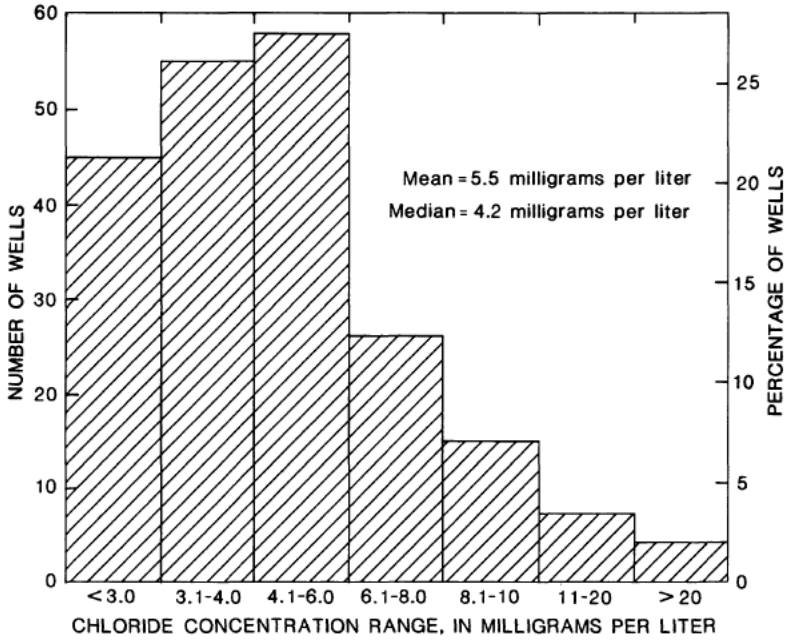


Figure 20.--Frequency distribution of chloride concentrations in Bainbridge Island ground water, September 1985.

3) 2006 Aspect Baseline GW Summary 1 Part 1, p.10

occurred between August 1998 and April 1999. This well apparently has not been surveyed and the elevation of the completion depth of the well relative to sea level is unknown.

Fletcher Bay well (20K04) had a single time chloride value of 48 mg/L in October 2001. The following data suggest this value is anomalous.

- Quarterly Cl measurements in 2002 were all low (5 mg/L),
- 2002 annual pumpage exceeded that of 2001,
- Peak monthly pumpage in 2002 was greater than 2001,
- Pumping elevation in 2002 was lower than 2001, and
- 2002 is further into a drying trend that started in 1999.

As such, the 48 mg/L value is considered an outlier.

7.2.3 North Island Wells

The north portion of Bainbridge Island, north of the Port Madison inlet, has the two highest chloride levels identified in the data reviewed. Well 34L06 (Samson Water Systems) is completed in the SLA and had elevated chloride of 424 mg/L in August 1993, the first available data for this well. Chloride concentrations in this well declined after this measurement and were reported less than 5 mg/L for the most recent available data (August 2004). The WRIA 15 report indicated the Seabold Water System well completed in the SLA increased in chlorides from a low value in 1998 to a chloride concentration of 419 mg/L (December 2000). No data was available for this well after this date to review subsequent trends. The Level II basin assessment indicates elevated specific conductance for three wells located along the west side of the north portion of Bainbridge Island.

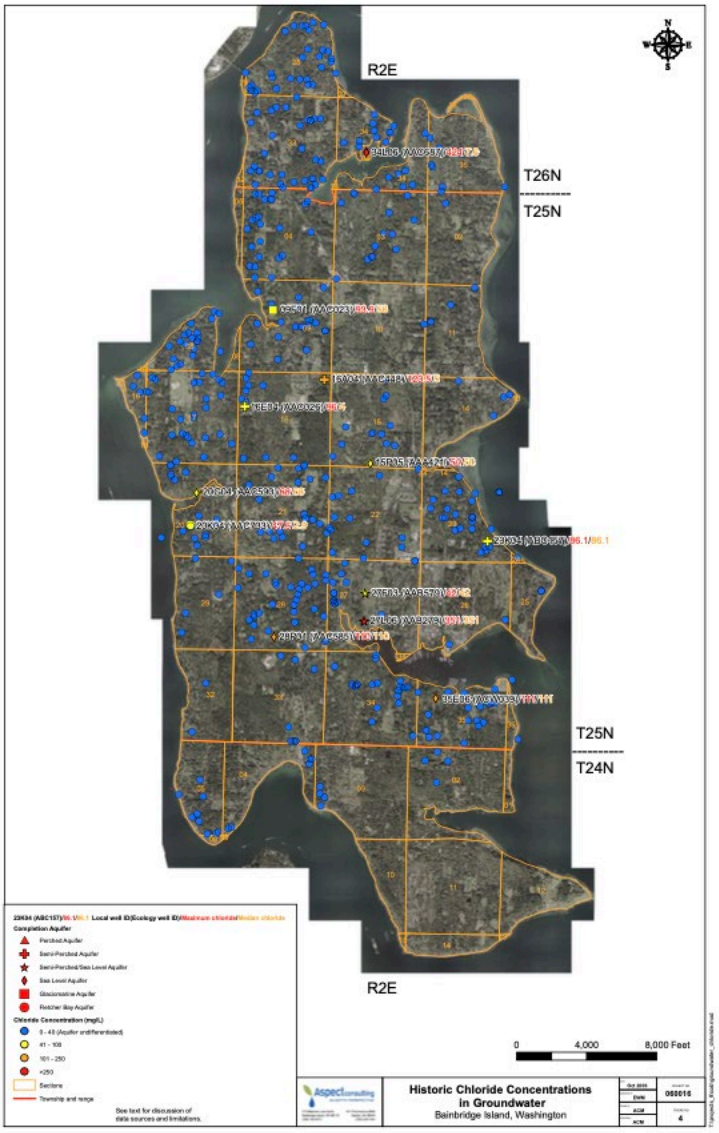
7.2.4 East Side Wells

Four wells, 23K04 (private well), 27F03 (Bainbridge Green), 27L06 (private well), and 35E06 (private well) were identified on the east side of the island with chloride concentrations ranging from 42 to 351 mg/L. Only a single reported chloride value was available for each of these wells. These wells are completed in the SLA or SPA and three of these wells are located adjacent to Eagle Harbor. Wells 23K04, 27F03, and 35E06 correspond to areas of relatively higher groundwater withdrawals.

7.3 Monitoring Implications

The WRIA 15 water quality report indicates that a threshold distance between a ¼ and ½ mile of the coast may exist for seawater intrusion (Golder Associates, Inc., 2003). Inland wells identified on Figure 4 with elevated chloride levels are likely related to upconing or completion of the well screen or open interval within the transition zone. Wells located within a ¼ mile of the coast may be indicative of either lateral intrusion or upconing. Chloride monitoring should focus on wells located within ¼ mile of the coast. The available data suggest the north island area (Seabold, Agate Pass and Port Madison) and the Eagle Harbor area may be more susceptible to seawater intrusion and should be considered in designing the monitoring network.

5


R2E
T26N
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T25N
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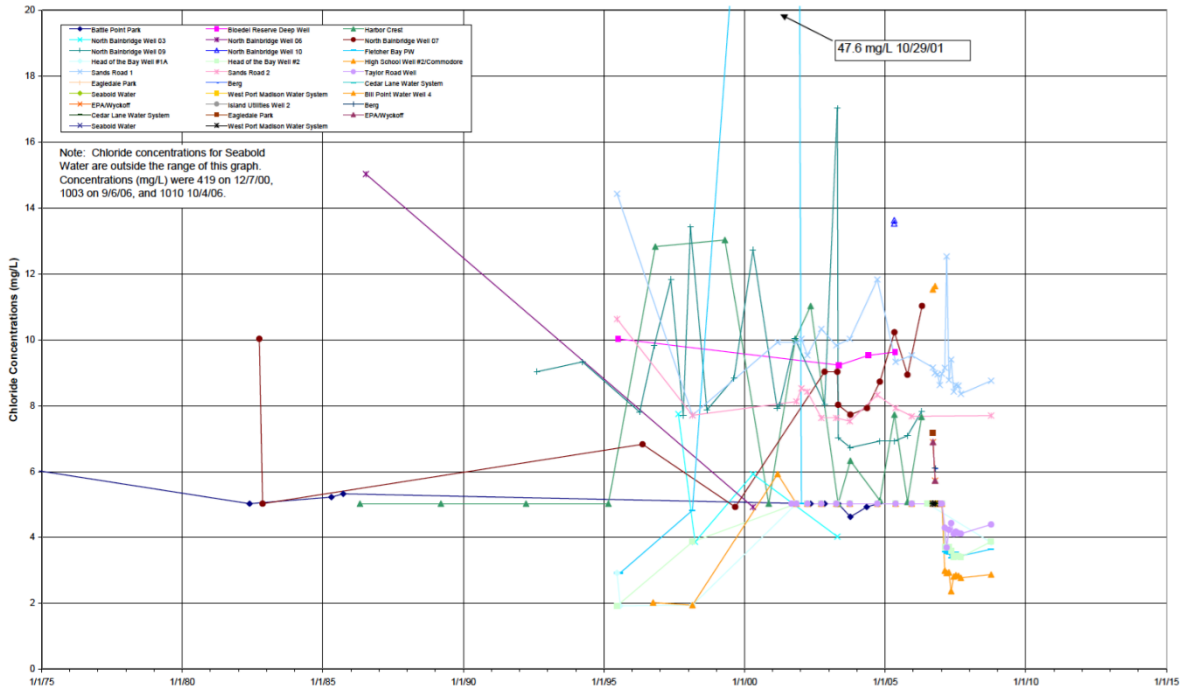
R2E
0
4,000
8,000 Feet
Historic Chloride Concentrations
in Groundwater
Bainbridge Island, Washington
060016

4) Groundwater Monitoring Program Update - March 2009 Prepared for: City of Bainbridge Island, WA (Aspect)
PROJECT NO. 060016-003-02 DECEMBER 2008 (REVISED MARCH 2009)
https://www.bainbridgewa.gov/DocumentCenter/View/2622/Groundwater-MonitoringProgram_Update_2009_Part1?bidId=

Page 10: Fig 11

3.2.2 Chloride Concentration
A geographically comprehensive investigation of chloride has not been performed on Bainbridge Island. Most routine monitoring for chloride began in the mid-1990s and was expanded as part of the groundwater management plan in 2006 to include 29 wells. Historic data on chloride concentrations (Figure 11) was compiled and reported in the Groundwater Baseline memorandum (Aspect, 2006a). Nine wells within 1⁄4 mile of the coastline and two inland wells exhibited elevated chloride levels. Most of the wells with elevated chloride had only single measurements. Additional sampling is necessary to determine if those measurements are repeatable. In addition, we recommend that a set of wells, located within a 1⁄4 mile of the coastline and completed below sea level, be identified for specific conductance and/or chloride measurements. A more comprehensive geographic distribution of wells with chloride data will be useful for identifying regional areas of seawater intrusion.



Aspect Consulting

11/21/2008

W:\060016 Bainbridge Island - GW Mgt\GMP\GMP 2008\DRAFT\2008 GW Update Graphs Final.xls - Chloride Chart

Figure 11
Historic Chloride Concentrations in Groundwater
Groundwater Monitoring Program, Bainbridge Island, WA

Other Documents For Chloride/Seawater Intrusion, Water Level language to help update EWL criteria

1) December 2000, COBI Level II Assessment, Kato & Warren Inc., Robinson and Noble, Inc., (Not in COBI Water Resources Library)
https://www.kpud.org/downloads/Bainbridge%20Island%20Level%20II%20Assessment.pdf

1. P9-7
   ...It must be noted that all of the groundwater resource available (less the supply to stream baseflow) is not available for allocation. To prevent seawater intrusion, a portion of the resource must be left in the aquifers to maintain the differential pressure between freshwater and seawater. Also because of the physical and economic limitations, not all of the ground water can be extracted by wells.
   1988 reference P.41. **Ghyben-Herzberg Principa**l states, at any particular location, for every 1 foot of altitude of the water table above sealevel, fresh groundwater will extend 40' below sea level (1:40 ratio).
2. 11-1 thru 11-2 Recommendations from Level II Assessment still relevant for 2022 GWMP

2) 2013 COBI Groundwater Level Summary without FBA Aquifer data. P.2, Do not include this

reporting claiming 'without exceedance of EWL,' **not inclusive of Fletcher Bay Aquifer**.

"In general, water levels in all aquifers appeared to remain steady or varied in accordance with changes in rainfall. None of the monthly monitored wells demonstrated water level declines in exceedance of the EWL....**The GMP's monthly monitoring network does not include any wells in the deepest aquifer, the Fletcher Bay Aquifer**. These deep wells are predominantly production wells or municipal monitoring wells operated by the City's Water Utility or other public water purveyor such as the Kitsap Public Utility District. Data from the deep wells were examined for comparison to monthly monitored data, but are not provided here..."

See COBI EWL Assessment July 2017 instead P.11 "The only **well to exceed the safe yield EWL was KPUD's Island Utilities Well 1 (25N/02E-34F07) with a trend of -0.69 feet per year over the last ten years.** After examining historical water level and production data for this well and co-located wells, Mr. Sebren considered this a localized decline in water levels that has not yet been fully assessed (telephonic communication, August 19, 2016. See Section 3.3 for further discussion regarding this well."

3) COBI 2013 Seawater Intrusion Assessment GMP, P1 "Through the use of Early Warning Levels (EWLs), the City is able to identify potential developing impacts for further investigation. The EWL for chloride concentration is at or above 100mg/L (based on Ecology's draft Seawater Intrusion Policy, Washington DOE, 1990) or any increasing trend in chloride concentration.

However, specific determination of seawater intrusion requires additional confirmation monitoring in any suspect areas."

4) Look at 2009 Aspect for recommendation for EWL criteria update language or earlier reports.

200665

26-2E-33E

☑ Construction ☐ Decommission — Original Installation Notice of Intent Number:

Washington State Dept. of Ecology Water Well Report

Original-Ecology, Copy 1-Owner, Copy 2-Driller

Proposed Use ☑ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other

Type of Work:

Owners number of well (if more than one):

☑ New Well ☐ Reconditioned ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☑ Cable ☐ Rotary ☐ Jetted

Dimensions

Diameter of well inches: 6 Feet Drilled: 648

Depth of Completed Well Ft: 639

Construction Details: Casing Installed:

☑ Welded 6 " Diam. from 0 ft to: 639 ft

☐ Liner " Diam from 0 ft to 0 ft

☐ Threaded 0 " Diam from 0 ft to 0 ft

Perforations: ☐ Ye ☑ No

Type of perforator used:

Perf Size 0 in by 0 in and no of perfs 0 from 0 ft to 0

Screens: ☐ Ye ☑ No ☐ K-Pac Location:

Manufacuters Name:

Type: Model No:

Diam 0 Slot Size: 0 from 0 ft to 0 ft

Diam 0 Slot Size: 0 from 0 ft to 0 ft

Gravel/Filter Packed: ☐ Ye ☑ No Size of Gravel/Sand:

Materials placed from: 0 ft to 0 ft

Surface Seal ☑ Ye ☐ No To what depth? 23 ft

Material Used in Seal: bentonite

Did any strata contain unusable water? ☐ Ye ☑ No

Type of Water? Depth of strata 0 ft

Method of sealing strata off:

Pump: Manufacturers Name:

Type: HP:

Water Levels: Land-surface elvation above mean sea level 80 ft

Static level 0 ft below top of well. Date:

Artesian pressure 0 lbs per square in. Date

Artesian water is controlled by:

Well Tests:

Was a pump test made? ☐ Ye ☑ No If yes by whom?

Yield: 0 gal/min with 0 ft drawdown after 0 hrs

Yield: 0 gal/min with 0 ft drawdown after 0 hrs

Yield: 0 gal/min with 0 ft drawdown after 0 hrs

Time	Water Level	Time	Water Level	Time	Water Level
	0		0		0
	0		0		0
	0		0		0

Pump Test Date:

Bailer Test 0 gal/min with 0 ft drawdown after 0 hrs

Airtest 0 w/stem set at 0 ft for 0 hrs

Artesian flow 0 g.p.m Date

Temp of Water: Was a chemical analysis made? ☐ Ye ☑ No

Current:

Notice of Intent No: W208534

Unique Ecology Well ID Tag No AES495

Water Right Permit No:

Property Owner Name: Mezam Tooloee

Well Street Address: 6600 NE Seabold Rd

City B.I. County: #18 KITSAP

Location SW 1/4-1/4 NW 1/4 Sec 33 Twn: 26N R: 2

Lat Deg: Lat Min/Sec: ☑ EWM

Long Deg: Long Deg/Sec: ☐ WWM

Tax Parcel No: 33260220282009

Construction or Decommission Procedure

Formation: Describe by color, character. size of material and structure, and the kind and nature of material in each stratum penetrated, with at least one entry for each change of information indicate all the water encountered.

Material		From	T
Loam rocky clay	brown	0	4
Sand claybound	brown	4	26
Silt compact hard sandy	blue	26	61
Silt compact	blue	61	126
Silt compact sandy w/ peat	blue	126	154
Silt compact	gray	154	207
Silt compact w/ grits	gray	207	221
Silt compact hard	gray	221	435
Silt compact sandy	gray	435	477
Silt compact hard	gray	477	519
Silt compact sandy hard	gray	519	589
Silt compact hard	gray	589	645
Silt compact sandy w/rocks	gray	645	
		0	0
		0	0
		0	0
to be completed by a mud rotary		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0

RECEIVED
JUL 12 2006
DEPT. OF ECOLOGY

Start Date: 6/15/2006 Completed Date: 7/7/2006

Well Construction Certification: I constructed and/or accept responsibility for the construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☑ Driller ☐ Engineer ☐ Trainee Name: Glen Crabtree

Driller/Engineer/Trainee Signature: Glen Crabtree

Driller or Trainee License No: 1443

If trainee, licensed driller's

Signature and License No.

Drill Co Name: Crabtree Well Drilling

Address: 33349 Eglon Rd NE

City,State,Zip: Kingston, WA 98346-

Contractors Registration No: CRABTDC09702 Date: 7/7/2006

255134 26-2E-33E

☐ Construction Original Installation Notice of Intent Number:
☑ Decommission

Washington State Dept. of Ecology Water Well Report
Original-Ecology, Copy 1-Owner, Copy 2-Driller

Proposed Use ☑ Domestic ☐ Industrial ☐ Municipal
☐ DeWater ☐ Irrigation ☐ Test Well Other
Type of Work:
Owners number of well (if more than one):
☐ New Well ☐ Reconditioned ☐ Dug ☐ Bored ☐ Driven
☐ Deepened ☑ Cable ☐ Rotary ☐ Jetted

Dimensions
Diameter of well inches: 6 Feet Drilled: 0
Depth of Completed Well Ft: 121

Construction Details: Casing Installed:
☑ Welded 60 " Diam. from 0 ft to: 111 ft
☐ Liner " Diam from 0 ft to 0 ft
☐ Threaded 0 " Diam from 0 ft to 0 ft
Perforations: ☐ Ye ☑ No
Type of perforator used:
Perf Size 0 in by 0 in and no of perfs 0 from 0 ft to 0
Screens: ☐ Ye ☐ No ☐ K-Pac Location:
Manufacuters Name:
Type: Model No:
Diam 0 Slot Size: 0 from 0 ft to 0 ft
Diam 0 Slot Size: 0 from 0 ft to 0 ft
Gravel/Filter Packed: ☐ Ye ☐ No Size of Gravel/Sand:
Materials placed from: 0 ft to 0 ft
Surface Seal ☑ Ye ☐ No To what depth? 20 ft
Material Used in Seal: bentonite
Did any strata contain unusable water? ☐ Ye ☐ No
Type of Water? Depth of strata 0 ft
Method of sealing strata off:
Pump: Manufacturers Name:
Type: HP:
Water Levels: Land-surface elvation above mean sea level 95 ft
Static level 93 ft below top of well. Date:
Artesian pressure 0 lbs per square in. Date
Artesian water is controlled by:
Well Tests:
Was a pump test made? ☐ Ye ☑ No If yes by whom?
Yield: 0 gal/min with 0 ft drawdown after 0 hrs
Yield: 0 gal/min with 0 ft drawdown after 0 hrs
Yield: 0 gal/min with 0 ft drawdown after 0 hrs

Time	Water Level	Time	Water Level	Time	Water Level
	0		0		0
	0		0		0
	0		0		0

Pump Test Date:
Bailer Test 0 gal/min with 0 ft drawdown after 0 hrs
Airtest 0 w/stem set at 0 ft for 0 hrs
Artesian flow 0 g.p.m Date
Temp of Water: Was a chemical analysis made?
☐ Ye ☑ No

Current:
Notice of Intent No: A099822
Unique Ecology Well ID Tag No
Water Right Permit No:
Property Owner Name: Mezam Tooloee
Well Street Address: 6600 NE Seabold Rd
City B.I. County: #18 KITSAP
Location SW 1/4-1/4 NW 1/4 Sec 33 Twn: 26N R: 2
Lat Deg: Lat Min/Sec: ☑ EWM
Long Deg: Long Deg/Sec: ☐ WWM
Tax Parcel No: 33260220282009

Construction or Decommission Procedure
Formation: ~~Describe by color, character. size of material~~ and structure, and the kind and nature of material in each stratum penetrated, with at least one entry for each change of information indicate all the water encountered.

Material	From	T
Hole was filled with pea gravel	121	94
bentonite was installed	94	1
concrete cap to grade	1	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
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	0	0
	0	0

RECEIVED
FEB 12 2007
DEPT. OF ECOLOGY

Start Date: 2/2/2007 Completed Date: 2/5/2007

Well Construction Certification: I constructed and/or accept responsibility for the construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☑ Driller ☐ Engineer ☐ Trainee Name: Glen Crabtree
Driller/Engineer/Trainee Signature [signature]
Driller or Trainee License No: 1443
If trainee, licensed driller's
Signature and License No.

Drill Co Name: Crabtree Well Drilling
Address: 33349 Eglon Rd NE
City,State,Zip: Kingston, WA 98346-
Contractors Registration No: CRABTDC09702 Date: 2/7/2007

26-2E-33E

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission ("x" in circle) 212141

● Construction

○ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

CURRENT

Notice of Intent No. WE 05810

Unique Ecology Well ID Tag No. AES495

Water Right Permit No. N/A

Property Owner Name NEZAM TOOLEE

Well Street Address 6600 NE SEABOLD Rd.

City Bainbridge Is County 18-NWR Kitsap

Location SW 1/4-1/4 NW 1/4 Sec 33 Twn 26 R 2E (EWM or WWM) circle one

Lat/Long (s, t, r Still **REQUIRED**) Lat Deg — Lat Min/Sec —

Long Deg — Long Min/Sec —

Tax Parcel No. 332602202820009

PROPOSED USE: ● Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____

● New well ☐ Reconditioned *Method* ☐ Dug ☐ Bored ☐ Driven ● Deepened ☐ Cable ● Rotary ☐ Jetted

DIMENSIONS: Diameter of well 5 7/8 inches, drilled 1015 ft. Depth of completed well 1015 ft.

CONSTRUCTION DETAILS

Casing Installed: ● Welded 6 " Diam. from +2 ft. to 640 ft.

● Liner installed 4 " Diam. from 620 ft. to 973 ft.

☐ Threaded _____ " Diam. from _____ ft. to _____ ft.

Perforations: ☐ Yes ● No

Type of perforator used _____

SIZE of perfs _____ in by _____ in and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ● Yes ☐ No ● K-Pac Location 620

Manufacturer's Name Johnson

Type SS Model No _____

Diam. 3 Slot size .008 from 973 ft. to 995 ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ● No ☐ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ● Yes ☐ No To what depth? 18 ft

Material used in seal BENTONITE chips

Did any strata contain unusable water? ☐ Yes ● No

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

PUMP: Manufacturer's Name N/A

Type. _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level 136 ft.

Static level 93 ft below top of well Date 11/29/06

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ● No If yes, by whom? _____

Yield _____ gal /min. with _____ ft drawdown after _____ hrs.

Yield: _____ gal /min. with _____ ft. drawdown after _____ hrs.

Yield. _____ gal./min with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 10 gal./min. with stem set at 600 ft. for 4 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? ☐ Yes ☐ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
This well was deepend from 640' TO 1015'		
SILT, Sandy, Gray	645	710
SILT, Gray	710	795
SILT Sandy, Gray	795	810
SILT, Gray	810	973
Sand Medium, Some Fine's, Some occasional Gravel's	973	995
Sandy SILT, gray	995	1012
SILT, Gray	1012	1015

RECEIVED
DEC 12 2006
DEPT. OF ECOLOGY

Start Date 10/18/06 Completed Date 11/4/06

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

● Driller ☐ Engineer ☐ Trainee Name (Print) CHRIS V GREGORY

Driller/Engineer/Trainee Signature _____

Driller or trainee License No 2534

Drilling Company GREGORY DRILLING

Address 17609 NE 70th St

City, State, Zip REDMOND WA 98052

Contractor's Registration No. GREGOD111057P Date 11/28/06

If TRAINEE, Driller's Licensed No. _____ Driller's Signature _____

Ecology is an Equal Opportunity Employer.

ECY 050-1-20 (Rev 3/05) **The Department of Ecology does NOT warranty the Data and/or Information on this Well Report.**

280081

WATER WELL REPORT

26-2E-33E

Original & 1st copy - Ecology, 2nd copy - owner, 3rd copy - driller

Construction/Decommission ("x" in circle)

☒ Construction

☐ Decommission *ORIGINAL INSTALLATION*

Notice of Intent Number _____

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other Group B

TYPE OF WORK: Owner's number of well (if more than one) _____

☒ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 1005 ft. Depth of completed well 985 ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 10 " Diam. from 0 ft. to 50 ft.

☐ Liner installed 6" " Diam. from +2 ft. to 925 ft.

☐ Threaded _____ " Diam. From _____ ft. to _____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☒ Yes ☐ No ☐ K-Pac Location _____

Manufacturer's Name Alloy

Type Stainless Steel Model No. _____

Diam. 2 Slot size Blnk from 884 ft. to 905 ft.

Diam. 2 Slot size .015 from 905 ft. to 985 ft.

Gravel/Filter packed: ☒ Yes ☐ No Size of gravel/sand Monteray 2/12

Materials placed from 884 ft. to 985 ft.

Surface Seal: ☒ Yes ☐ No To what depth? 925 ft.

Material used in seal Neat Cement

Did any strata contain unusable water? ☒ Yes ☐ No

Type of water? Salt Water Depth of strata 165

Method of sealing strata off Neat Cement

PUMP: Manufacturer's Name Sta-Rite

Type: Submersible 5P H.P. 1.5

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 93.5 ft. below top of well Date 11/8/07

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom? _____

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer Test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 5 gal./min. with stem set at 600 ft. for 8 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? ☒ Yes ☐ No

CURRENT

Notice of Intent No. WE07573

Unique Ecology Well ID Tag No. ALA 779

Water Right Permit No. N/A

Property Owner Name Seabold Community Water System

Well Street Address 15375 Harvey Rd NE

City Bainbridge Island County Kitsap

Location SW 1/4-1/4 NW 1/4 Sec 33 Twn 26 R 2 EWM ☒ Check Or WWM ☐ One

(s, t, r Still REQUIRED)

Lat/Long Lat Deg _____ Lat Min/Sec _____

Long Deg _____ Long Min/Sec _____

Tax Parcel No. (Required) 33260220242003

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL		FROM	TO
Gravel pad		0	1
Sand and gravel	Br	1	41
Sandy silt	Gr	41	129
Sand w/ scattered gravels		129	145
Silty sand/sandy silt		145	195
Sand - medium some silt		195	230
Sand w/scattered gravels		230	238
Silty fine sand		238	375
Clayey silt		375	391
Sand and silt interbedded		391	398
Sand		398	420
Sandy silty		420	430
Sand w/some silt		430	495
Clayey silt		495	519
Sand		519	529
Clayey silt		529	570
Sand w/scattered gravels		570	582
Fine sand/silt interbeded		582	630
Fine sand w/silt beds and scattered gravels		630	632
Clay/silt		632	635
Interbeded fine sand/silt w/occasional gravel		635	676
Silty fine sand w/gravel layers and clay layers		676	859
Silty clayey fine sand - dirty		859	919
Gravels -small with silty matrix		919	924
Sand-fine with gravels layers, gravels become		-	-
more abundant with depth		924	969
Sand fine to medium clean		969	1005

RECEIVED

DEC 18 2007

DEPT. OF ECOLOGY

Start Date 10/20/07 Completed Date 11/08/07

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Chad N Gregory

Driller/Engineer/Trainee Signature _____

Driller or trainee License No. 2369

IF TRAINEE: Driller's License No: _____

Driller's Signature: _____

Drilling Company Gregory Drilling Inc

Address 17609 NE 70th St

City, State, Zip Redmond , WA , 98052

Contractor's Registration No. GREGODI110JP Date 12/10/07

ECY 050-1-20 (Rev 4/07)

Ecology is an Equal Opportunity Employer

All may not be well with water supply

When Jim Martine moved to Seabold 30 years ago, he wasn't one of the lucky few to snag a waterfront view. But these days, Puget Sound seems so close he can taste it.

February 26, 2007 4:00 pm

When Jim Martine moved to Seabold 30 years ago, he wasn't one of the lucky few to snag a waterfront view. But these days, Puget Sound seems so close he can taste it.

"It's everywhere – the salty water's in the shower, the dishwasher, the appliances," the Harvey Road resident said. "Everywhere you get a white, crusty build-up of salt. You can't wash the windows. When you wash the car, it leaves a crusty film."

Saltwater has, over the last two years, seeped into the well Martine shares with seven of his neighbors. Increased pumping from "more straws in the same glass," Martine said, is sucking out the freshwater and drawing in Puget Sound.

Martine is one of many islanders concerned that the underground aquifers that supply all the island's water needs may soon fail to quench the island's growing thirst.

For Martine, what may become the island's "biggest issue" is today hinted at by his garden hose, which fires sea spray over an increasingly unhappy lawn and killed his dahlias.

He offers to pour a tall, briny glass from his tap, but declines any such offer himself.

“You can’t drink that,” Martine said. “It’s unhealthy.”

Martine is adapting. His family buys bottled water by the gallon and keep their mouths shut tight while showering. He’s talking with other neighbors about sharing wells, or an expensive well retrofit that may bypass and insulate the salty aquifer.

Rep. Sherry Appleton has a bigger fix in mind. The Poulsbo Democrat introduced legislation in Olympia that would allow Bainbridge Island to restrict growth based on the available supply of groundwater.

“The bill stemmed from the concern that Bainbridge Island could not support the new growth it is mandated to take as a fully incorporated island city,” Appleton said of House Bill 1134, which passed the House unanimously Friday morning, and is now headed to the Senate. “This bill helps the island determine where they want residential growth, keeping in mind that Bainbridge has water resource problems now.”

How big that problem is – or whether there’s a problem at all – is the subterranean puzzle city water resources specialist Jalyn Cummings is trying to solve.

Cummings recently embarked on a two-year ground water monitoring program in collaboration with the United States Geological Survey. The program, estimated to cost the city about $500,000, will test up to 80 wells and establish a broad baseline of data on underground water levels, saltwater intrusion areas and the rates at which rainfall recharges island aquifers. Cummings will then use this data to craft a model to help predict how increased use will affect groundwater.

“This will help us answer the questions everybody’s asking me,” she said. “Right now, I can’t answer – that’s why this work needs to be done.”

The answer, said City Councilman Bill Knobloch, could “turn Bainbridge into

a different community overnight."

"We're starting to see the red flags – saltwater intrusion, levels dropping," he said. "We could be reaching our limit. This may mean some real changes in our management policies."

Councilman Chris Snow, who traveled to Olympia last week to testify in favor of Appleton's bill, said the city may need to rein in growth if water proves in short supply.

"This bill will help our island grow in a sustainable way," Snow said in testimony to a House committee.

The city's lead long-range planner Libby Hudson also expressed support for the bill.

"This will create another tool to manage both our aquifers and our land use and the relationship between the two," she said.

For Martine, the relationship is crystal clear.

"Thirty years ago, Harvey was a dead end road of four homes, two of which were original homesteaders," he said. "Now we've got 26 typical Bainbridge family houses – all of which have poked their straws in and are drawing water. Now we have a problem."

The average Washington household uses about 300 gallons of water per day, according to the state Department of Ecology. With 22,000 people in nearly 8,000 households, Bainbridge homes draw a daily 2.4 million gallons of water from aquifers at various depths.

The Fletcher Bay aquifer, the island's largest and most used, has seen a "substantial and unrecovered drop in water levels," according to a December 2006 report prepared for the city by Aspect Consulting.

“We’ve seen a 10 to 15 foot drop there since 1994,” Cummings said. “That’s substantial.”

The Meadowmeer area has also exhibited anecdotal evidence of ground water declines, according to Aspect’s report.

While the city’s last water resources assessment reported that testing in 1985 and 1988 showed no saltwater contamination, Aspect’s 2006 report listed intrusion in Seabold, Agate Point, Port Madison and Eagle Harbor area wells.

The movement of saline water into freshwater aquifers is usually caused by ground water pumping from coastal wells, according to the USGS. In extreme cases, saltwater contamination has led to the abandonment of supply wells.

Despite the growing evidence of island groundwater depletion and contamination, Cummings stressed that now is the “time to plan, not to panic.”

“I’ve seen nothing that worries me, except in Seabold, where it’s getting salty,” she said.

Appleton’s bill, combined with the city’s monitoring program, will provide the necessary tools to avoid water scarcities, Cummings said.

In the meantime, Councilman Nezam Tooloee cautioned against tainting island water with politics. While Tooloee, a neighbor of Martine’s, has had his own problems with saltwater intrusion, spurring him to dig deep – over 1,000 feet deep – to find a new source of fresh water, he hopes islanders will wait until the murkiness surrounding the aquifer issue clears.

“People make wild claims about water as a political tool to push their agendas,” Tooloee said. “Whether you’re for pulling up the drawbridge and not allowing one more person, or you want to remove all land use controls

and do whatever you want, politicizing water borders on the indecent for me. Water is the life-giving resource. Not telling the truth about water is not OK."

That's why Tooloee is asking the anti- and pro-growth factions to ease up until the monitoring is complete.

"That project is the gold standard for us to understand our aquifers" and help the council "make good policy," he said.

The program's results could also spark controversy, as was the case when the city released its last water resources assessment.

"It was from one line, in paragraph two in the summary," Cummings said of the assessment prepared by Kato & Warren consultants in 2000. "It was a bold statement and it was met with some resistance."

The line read: "....natural groundwater recharge on the Island is sufficient to meet the Island's needs at full development under current zoning."

At the same time, the assessment noted problems with recharging the supply, including retention pond overflows during moderate rains, excessive wetness due to poor drainage, as well as inadequate or unmaintained culverts and drainage corridors.

For many, the 2000 assessment sparked more questions and the need for harder data.

"That's what we're after," said City Engineer Bob Earl. "How much water is there? What's the rate at which it recharges? How do we plan for the future?"

Either way, Bainbridge will not become the desert wasteland some predict, Earl said.

"I think some people associate water with oil reserves," he said. "Oil doesn't

replenish itself. Water does."

In a "worst case scenario," the island still has options, albeit expensive and complicated ones, he said.

The island could pipe in water from wells across Agate Passage or build desalinization plants. The infrastructure to pipe in water could range up to $10 million, according to Earl.

Whether there's a nearby source large enough to fill the island's water shortfalls is a big unknown, he added.

Turning saltwater into drinking water is an even more unlikely scenario.

"If you want to spend a lot of money, desalinization is the way to do it," Earl said. "Lots of places with lots of cash and no water do it, like Saudi Arabia.

Here, where we don't have much sun to help with the huge evaporation beds, we'd have to use a lot of electricity – thousands of kilowatt hours a day even for a small plant."

For Knobloch, the only option on the table is to deal with the water under his feet.

"Who would give us water?" he asked. "And what would they charge us? It would be an extraordinary cost. No, we've got water right here. Let's deal with it and use some common sense."

https://www.bainbridgereview.com/

September 22, 2023

Collect rainfall

To the editor:

I would like to share my experience with water for household, garden and fire. I have been in the same location since 1963 (Port Madison – Ellingsen Road). Density is in competition for water for human use (potable), lawns, garden and protection from fire. If you increase density by zoning, be wary there is only one source for water, and it is rainfall.

Our first well was a dug well of 28 feet for a single residence. The water table was 18 feet from ground level. We owned 20 acres and believed our well was adequate. Within two years, we deepened the well to 52 feet. Two years later, we drilled down to 160 feet.

The city zoned the area one house per 2.5 acres. On the original 20 acres, there are now five wells. Zoning would allow for eight wells. We contributed to the density and water needs when we sold 10 of our 20 acres.

I do not know how low the water table is or the recovery rate, but I planted 18 cedar trees for privacy. I water them from rooftop rainfall capture and storage.

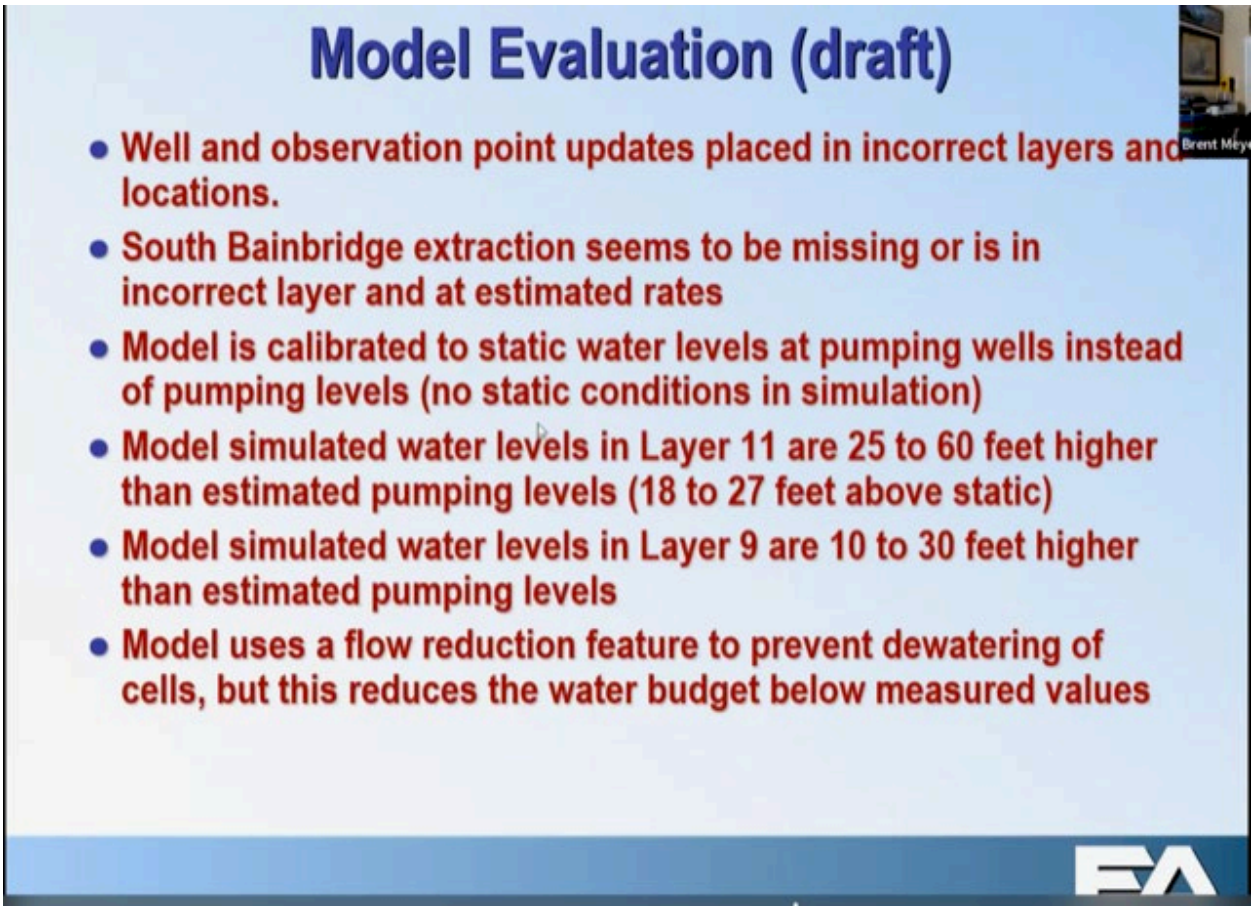
Zoning for new homes should include rainfall collection for both potable water and water for fire protection. Steel rooftops are a must.

Richard F. Krutch

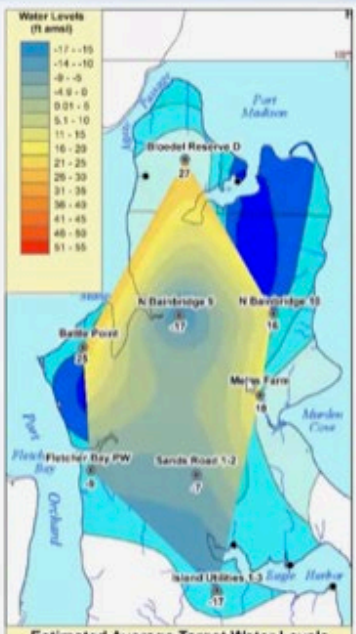
Bainbridge

> https://bainbridgewa.gov/AgendaCenter/Groundwater-Management-Plan-GWMP-Working-61/?#_09252023-1893

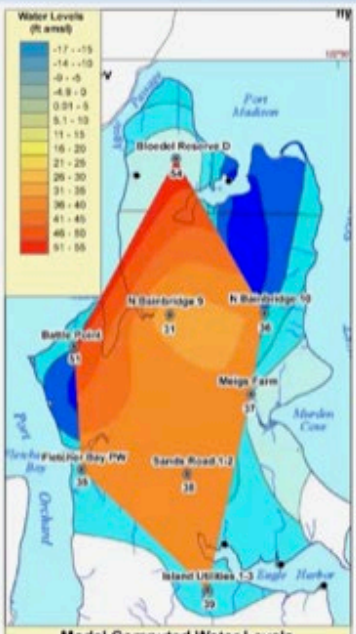
> Starting at 40:26 to 59:25 on September 25, 2023, EA's Brent Meyer generated this evaluation below of the Aspect BI Groundwater Model Update April 19, 2023:
>



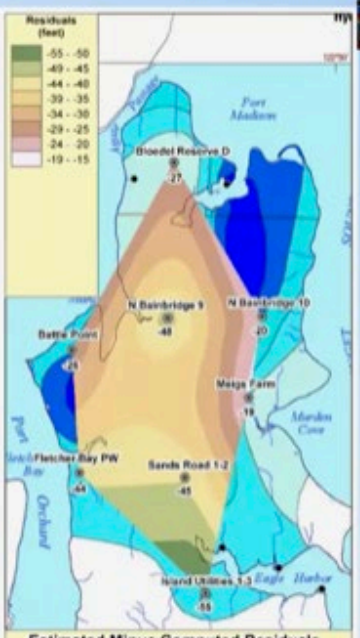
Layer 11 (Fletcher Bay Aquifer) Simulation



Estimated Average Target Water Levels
Fletcher Bay Aquifer
Accounts for Assigned Average
Monthly Pumping

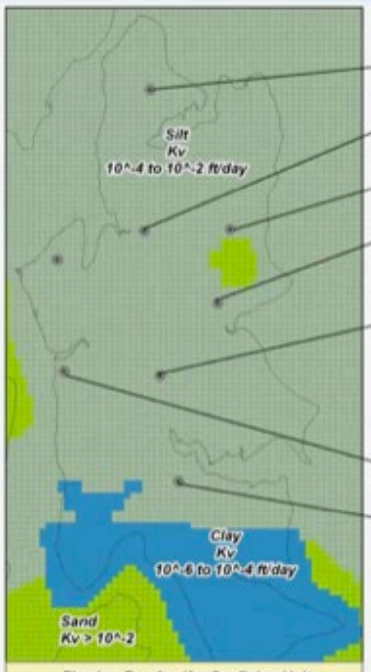


Model Computed Water Levels
Fletcher Bay Aquifer



Estimated Minus Computed Residuals
Fletcher Bay Aquifer

Model Hydraulic Properties (Layers 10 & 11)



Fletcher Bay Aquifer Confining Unit
Model Layer 10 (QC3)
Vertical Hydraulic Conductivity Distribution

Bloedel Reserve Deep Well

	Hydraulic Conductivity	Thickness
353 ft clay, sandy gravelly	Screen - 64 ft/day Aquifer - 13 ft/day Model - 116 ft/day	Screen - 20 ft Log Aquifer - 96 ft Modeled Aquifer - 59 ft

North Bainbridge Well 9

	Hydraulic Conductivity	Thickness
426 ft clay, silty clay 539 ft clayey silt 11 ft silt	Screen - 11 ft/day Aquifer - 4 ft/day Model - 4 ft/day	Screen - 100 ft Log Aquifer - 270 ft Modeled Aquifer - 454 ft

North Bainbridge Well 10

	Hydraulic Conductivity	Thickness
126 ft sandy clay	Screen - 65 ft/day Aquifer - 12 ft/day Model - 157 ft/day	Screen - 80 ft Log Aquifer - 213 ft Modeled Aquifer - 213 ft

Meigs Farm

	Hydraulic Conductivity	Thickness
30 ft clay	Screen - 28 ft/day Aquifer - 9 ft/day Model - 280 ft/day	Screen - 48 ft Log Aquifer - 110 ft Modeled Aquifer - 130 ft

Sands Road Wells 1

	Hydraulic Conductivity	Thickness
173 ft clay	Screen - 65 ft/day Aquifer - 13 ft/day Model - 300 ft/day	Screen - 90 ft Log Aquifer - 211 ft Modeled Aquifer - 154 ft

Sands Road Wells 2

	Hydraulic Conductivity	Thickness
145 ft clay, sandy clay	Screen - 36 ft/day Aquifer - 15 ft/day Model - 300 ft/day	Screen - 76 ft Log Aquifer - 102 ft Modeled Aquifer - 104 ft

Fletcher Bay PW

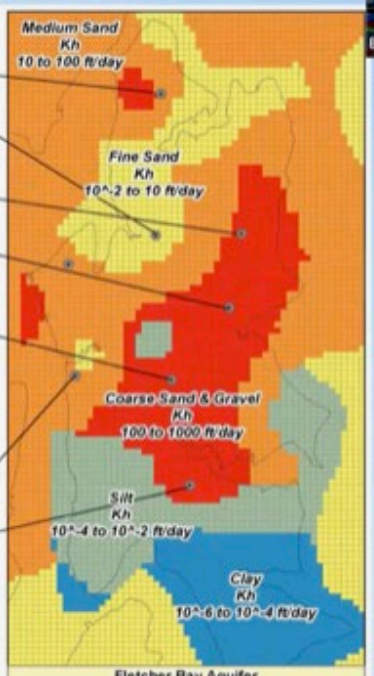
	Hydraulic Conductivity	Thickness
176 ft clay	Screen - 55 ft/day Aquifer - 14 ft/day Model - 14 ft/day	Screen - 30 ft Log Aquifer - 140 ft Modeled Aquifer - 90 ft

Island Utilities Wells 1

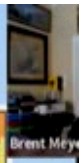
	Hydraulic Conductivity	Thickness
337 ft silt 11 ft clay 343 silt, clay	Screen - 5 ft/day Aquifer - 3 ft/day Model - 280 ft/day	Screen - 66 ft Log Aquifer - 83 ft Modeled Aquifer - 38 ft

Island Utilities Wells 3

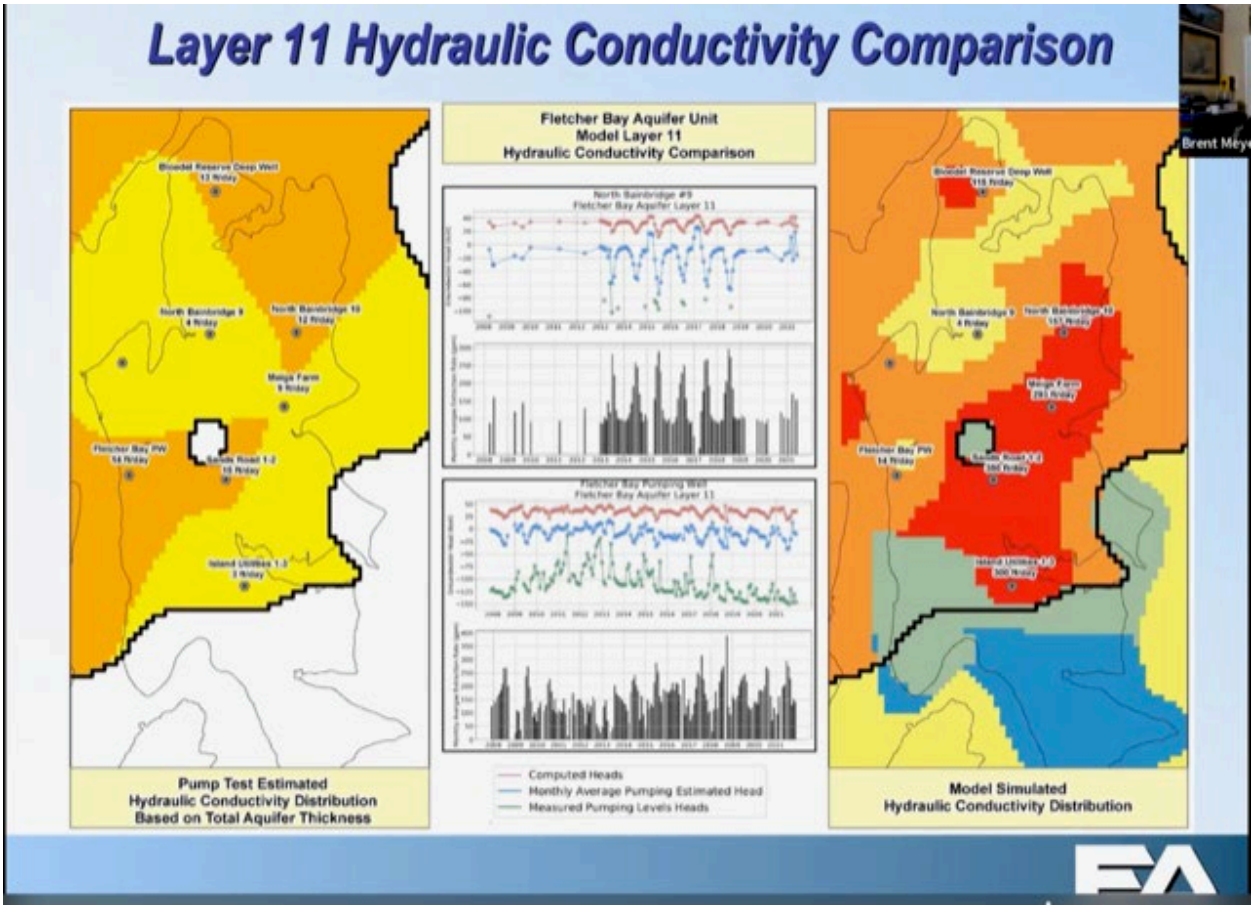
	Hydraulic Conductivity	Thickness
716 ft silt, with clay, sandy 17 ft silty clay	Screen - 6 ft/day Aquifer - 2 ft/day Model - 321 ft/day	Screen - 20 ft Log Aquifer - 69 ft Modeled Aquifer - 58 ft



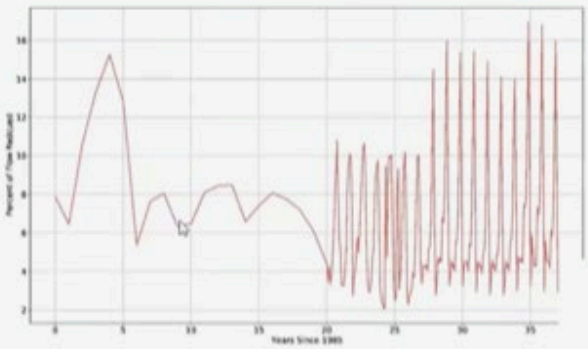
Fletcher Bay Aquifer
Model Layer 11 (FBA)
Horizontal Hydraulic Conductivity Distribution

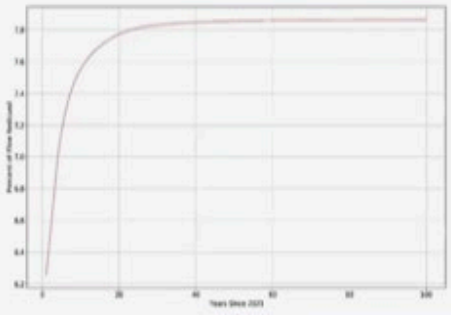


Layer 11 Hydraulic Conductivity Comparison



Flow Reduction Issue





Appendix C:

Groundwater-Flow System of Bainbridge Island, Washington

By Lonna M. Frans, Matthew P. Bachmann, Steve S. Sumioka, and Theresa D. Olsen

Abstract

Groundwater is the sole source of drinking water for the population of Bainbridge Island. Increased use of groundwater supplies on Bainbridge Island as the population has grown over time has created concern about the quantity of water available and whether saltwater intrusion will occur as groundwater usage increases. A groundwater-flow model was developed to aid in the understanding of the groundwater system and the effects of groundwater development alternatives on the water resources of Bainbridge Island.

Bainbridge Island is underlain by unconsolidated deposits of glacial and nonglacial origin. The surficial geologic units and the deposits at depth were differentiated into aquifers and confining units on the basis of areal extent and general water-bearing characteristics. Eleven principal hydrogeologic units are recognized in the study area and form the basis of the groundwater-flow model.

A transient variable-density groundwater-flow model of Bainbridge Island and the surrounding area was developed to simulate current (2008) groundwater conditions. The model was calibrated to water levels measured during 2007 and 2008 using parameter estimation (PEST) to minimize the weighted differences or residuals between simulated and measured hydraulic head.

The calibrated model was used to make some general observations of the groundwater system in 2008. Total flow through the groundwater system was about 31,000 acre-ft/yr. The recharge to the groundwater system was from precipitation and septic-system returns. Groundwater flow to Bainbridge Island accounted for about 1,000 acre-ft/yr or slightly more than 5 percent of the recharge amounts.

The calibrated model was used to simulate predevelopment conditions, during which no groundwater pumping or secondary recharge occurred and currently developed land was covered by conifer forests. Simulated water levels in the uppermost aquifer generally were slightly higher at the end of 2008 than under predevelopment conditions, likely due to increased recharge from septic returns and reduced evapotranspiration losses due to conversion of land cover from forests to current conditions. Simulated changes in water levels for the extensively used sea-level aquifer were variable, although areas with declines between zero and 10 feet were common and generally can be traced to withdrawals from public-supply drinking wells. Simulated water-level declines in the deep (Fletcher Bay) aquifer between predevelopment and 2008 conditions ranged from about 10 feet in the northeast to about 25 feet on the western edge of the Island. These declines are related to groundwater withdrawals for public-supply purposes.

The calibrated model also was used to simulate the possible effects of increased groundwater pumping and changes to recharge due to changes in land use and climactic conditions between 2008 and 2035 under minimal, expected, and maximum impact conditions. Drawdowns generally were small for most of the Island (less than 10 ft) for the minimal and expected impact scenarios, and were larger for the maximum impact scenario. No saltwater intrusion was evident in any scenario by the year 2035. The direction of flow in the deep Fletcher Bay aquifer was simulated to reverse direction from its predevelopment west to east direction to an east to west direction under the maximum impact scenario.

Appendix D:

2/28/17

WATER RESOURCES ELEMENT

TABLE OF CONTENTS

2016 COMPREHENSIVE PLAN **WATER RESOURCES ELEMENT**

2/28/17

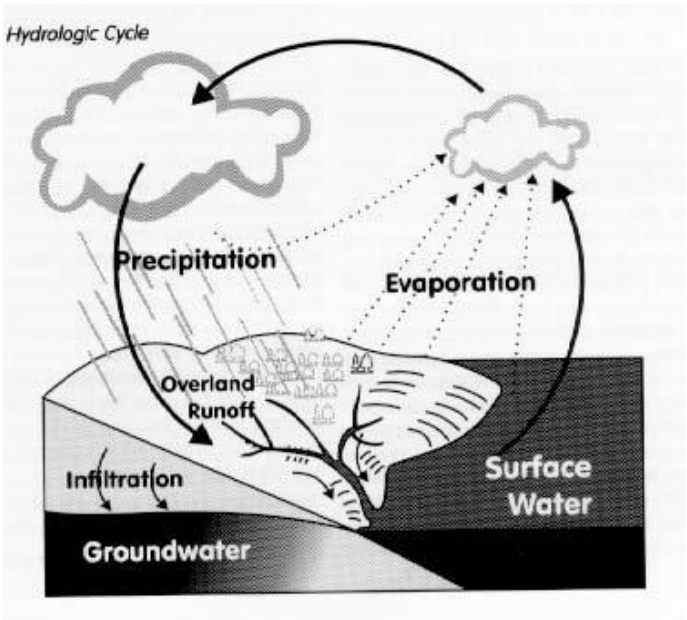
WATER RESOURCES INTRODUCTION

Bainbridge Island is solely dependent on groundwater for its drinking water and requires a holistic perspective to understand the interdependence among the Island's three primary water resources: *groundwater*, surface water and *stormwater*. Although these waters are typically regulated and managed independently, they are in nature, intimately connected.

Precipitation that is not evaporated or taken up by plants will follow one of three paths. It may infiltrate into the ground where it is called *groundwater*. It may drain directly into *streams* and harbors where it is called surface water or it may be captured by manmade *infrastructure* such as street drains, ditches or detention/retention ponds where it is called *stormwater*.

Groundwater may be pumped from wells to provide drinking water or irrigation or seep out of the ground into *streams*, springs and harbors where it is again called surface water. Likewise, *stormwater* may discharge into a nearby stream or harbor and become surface water or infiltrate into the ground and become *groundwater*. (see Fig.WR-1)

Fig. WR-1 The Hydrologic Cycle



2016 COMPREHENSIVE PLAN WR-1 **WATER RESOURCES ELEMENT**

2/28/17

In order to successfully protect and manage any one of these waters one must protect and manage all three. To address these interrelationships, a separate Water Resources Element has been developed as follows:

- • General water resources management policies
- • *Groundwater* protection and management policies
- • Surface water protection and management policies
- • *Stormwater* protection and management policies
- • Residential on-site sewage system policies

- • Contaminated sites policies
- • Public education and outreach policies

Land Use Connection

In the development of policies related to the management of our Island water resources, it is important to understand the links between water resources quality and quantity and *land use*. Most water quality and habitat integrity impacts are caused by the way land was or is used. Developed land allows for rapid *runoff* and inundation of natural conveyance systems such as *wetland*s and *streams*. Rapid *runoff* can cause damage through flooding, erosion and water-borne contamination.

In addition, *household*s create sewage that needs disposal either by a wastewater treatment plant or by residential on-site sewage systems. Wastewater treatment plants are reasonably effective at cleaning wastewater but do not at present provide complete removal of nitrogen nor treat for contaminants of emerging concerns that include but are not limited to, byproducts of medications, recreational drugs, health and beauty products and caffeine.

Residential on-site sewage systems can fail and cause contaminants to enter the surface water and/or *groundwater*. Even functioning systems, depending upon *density* and proximity to surface water and *groundwater*, can contribute to accumulations of nitrogen and contaminants of emerging concern in these waters.

Use of fertilizers, pesticides and other chemicals for cropland, lawns and gardens, and vehicle and *household* cleaning and maintenance as well as improper pet and livestock waste management can add significant contamination to surface water, *stormwater* and *groundwater*.

Commercial and industrial uses, past and present, leave behind pollutants in our soils. In particular, historic *land use*s such as large row crop agriculture, lumber, petroleum and others have left behind legacy pollutants in sediments both on upland properties and in the sediments along the bottoms of our *streams*, harbors and nearshore areas.

Without proper coordination of the regulations that will implement policy statements, conflicting signals may be given when dealing with water resources issues. For example, a surface water problem may be resolved by efficiently collecting and removing all water from the area whereas a *groundwater recharge* issue may require that the water be kept on-site to allow for infiltration.

Another conflict arises when infiltration of *stormwater* competes for space with on-site sewage systemdrainfields.Therearephysicallimitationstotheratesof infiltrationandabsorption based on soil types which may make it impossible to have both of those facilities on the same site. Where development occurs in important *aquifer recharge areas*, special consideration is needed to preserve the volume of *recharge* available to the *aquifer* and to protect the *groundwater* from

contamination. A key component of water resources protection and adaptive management is adequate monitoring in order to assess impacts of current land use and the effectiveness of applied management actions.

The overriding theme that runs through all of the policies and *goal*s in this element is the preservation and protection of water quality, water quantity, and ecological and hydrologic function.

Climate change

The 2016 Bainbridge Island Climate Impact Assessment, which is referenced in this Comprehensive Plan, establishes that a primary concern of *climate change* is the impact on *water resources*, especially for an island location like Bainbridge Island that relies solely on an *aquifer* system for its drinking water. *Climate change* projections indicate that over the coming decades sea level may rise up to four feet in the Puget Sound region, the ocean will become more acidic and climatic conditions are likely to become warmer. This will result in more intense rain events during the wet season with longer, drier summers, though overall annual volume of rainfall under current models is expected to remain approximately the same.

Ocean acidification will likely impact aquatic species survival and assemblages in our marine areas and sea level rise will likely impact habitat and built *infrastructure* in our nearshore areas including homes, businesses and public facilities such as roads and sewer facilities.

Wetter conditions during the wintertime will increase water availability but may cause flooding or diminish water quality. More intense and frequent storms or heavier rainfall events can cause *stormwater* inundation and localized flooding, chronic flooding, non-infiltrated run-off, erosion andlandslides.Increasedintensityofrainfallmayalsodiminish *aquiferrecharge*ratesas saturated soils are less able to absorb large amounts of water falling over short periods of time.

Warmer,drier conditionsinthesummertimewillincreaseevaporationratesandwaterdemand by plants, wildlife and people, and may diminish water quality. Dry conditions decrease water availability resulting in reduced stream flow and diminished *aquifer recharge*. Warmer and drier conditions can also reduce water quality, both by increasing in-stream temperatures and by concentrating contaminants in smaller volumes of water.

WATER RESOURCES VISION 2036

Bainbridge Island's water resources (precipitation on the surface and in the ground) are climate resilient and demand and quantity are adequate for all forms of life on the Island. *Aquifers* are continuously monitored and maintained above the early warning level. The water quality for most of the consumed water is monitored to ensure quality fully meets the standards for drinking water.

Education on water conservation results in a significant reduction in the average water consumption per *household*. The Bainbridge Island *groundwater* model is regularly updated with

new data and results from model runs are used to maintain long-term *sustainability* of the Island's water resources. *Low impact development* techniques are applied to all *land use*s and redevelopment.

GOALS & POLICIES

GENERAL WATER RESOURCES

GOAL WR-1

Manage the water resources of the Island in ways that preserve, protect, maintain, and where possible restore and enhance their ecological and hydrologic function.

- • Degradation of water resources is not allowed.
- • The long-term *sustainability* of the Island's water resources is maintained, taking into

  account future climatic conditions and their effects on the water cycle.

- • New development and population growth are managed so that water resources remain

  adequate and affordable for the indefinite future.

- • *Groundwater*, surface water and *stormwater* monitoring, data assessment and reporting are

  current and available including future projections of availability, quality and need.

- • Use current and future technology to maintain and protect water resources.

  Policy WR 1.1

  Study future climate and demand scenarios to accurately plan for future water resource conditions.

  Policy WR 1.2

  Groundwater, surface water and *stormwater* are resources that *shall* be protected and managed to preserve water quality and quantity, and to retain natural ecological and hydrologic function.

Policy WR 1.3

The City will provide sustainable water resource planning, protection, management and monitoring in coordination with government agencies at all levels, drinking water purveyors, Tribes, non-profit organizations, and other stakeholders.

Policy WR 1.4

Apply the policies in this element together with the protective measures set by the City's Shoreline Management Master Program, *Critical Areas* Ordinance and any other environmental or water resources management ordinance established by the City and in compliance with county, State, and federal laws and regulations.

Policy WR 1.5

Identify the areas of the Island that are the most vulnerable to pollution from concentrations of fecal coliforms and nitrates (for example, septic fields, agricultural activities, or fertilizers), and monitor those areas to determine if and when preventative or restorative measures are warranted.

GROUNDWATER PROTECTION AND MANAGEMENT

GOAL WR-2

Protect the quality and quantity of groundwater on the Island to ensure clean and sufficient groundwater for future generations.

Policy WR 2.1

Recognize that the Island functions as an *aquifer recharge area*. *Low impact development* techniques are essential for maintaining *aquifer recharge*.

Development, if any in areas with high *aquifer recharge* should be limited to low impact uses and less intense development. Low impact uses include development for buildings, roads or parking that has a reduced area of impact on the land. Low impact uses do not depend on regular applications of fertilizers or pesticides.

Low impact development is an environmentally-friendly approach to site development and *stormwater* management emphasizing the integration of site design and planning techniques that conserve and protect the natural systems and hydrologic functions of a site.

Policy WR 2.2

Identify and assess areas of high *aquifer recharge* as part of a *land use* application. Minimize the effect of development on these areas.

Policy WR 2.3

To promote efficient use of *groundwater* resources, encourage the expansion of existing water systems rather than encouraging shallow or individual residential wells.

Policy WR 2.4

Assess the impacts of proposed activities and development on the flow of springs and *streams* and levels of *wetland*s that are either sustained by *groundwater* discharge or contribute *recharge* to *groundwater*, and require an assessment of anticipated hydrologic impacts. Activities or development may be restricted if the report indicates any adverse impacts.

Policy WR 2.5

In cooperation with the appropriate regulatory agencies (e.g., Washington State Department of Health and the Kitsap Public Health District) institute new wellhead protection procedures.

Policy WR 2.6

Reduce the use of pesticides and herbicides by encouraging integrated pest management techniques and less toxic alternatives.

Policy WR 2.7

Establish a stakeholder group to develop an Island-wide *groundwater* management plan and work with Kitsap Public Utility District to update the Kitsap County Coordinated Water System Plan.

Policy WR 2.8

Develop an incentive based program to encourage exempt well owners to regularly monitor and report the quality of their well water and identify leaks using tools such as flow meters

Policy WR 2.9

Recognizing that the Island *aquifer* system is a Sole Source *Aquifer* as designated by EPA, consider creation and application of one or more aquifer conservation zones for appropriate areas of the Island and institute an added level of development and re-development permit review to prevent or mitigate potential pollutant-generating activities or activities that could affect stormwater runoff and aquifer recharge associated with a proposed *land use*. The Island's aquifers are protected through critical area regulations and Revised Code of Washington (RCW) 36.70A.550.

Policy WR 2.10

Retard seawater intrusion into our groundwater through the development and application of a comprehensive seawater intrusion prevention program.

Policy WR 2.11

Develop a water conservation program for all water uses on the Island.

Policy WR 2.12

Encourage water re-use and reclamation to serve as a supplementary source for high-water users such as industry, parks, schools and golf courses as approved by the Washington State Department of Health.

Policy WR 2.13

Require the retention of native landscapes to promote water quality and to reduce the need for irrigation.

Policy WR 2.14

Develop a program that incentivizes and facilitates innovative methods for homeowners and business owners to use stormwater and grey water as approved by the Washington State Department of Health and the Kitsap Public Health District.

Policy WR 2.15

Maintain a comprehensive program of *groundwater* data gathering, analysis, and reporting including modeling, hydrogeologic and geologic studies, and monitoring of static water levels, water use, water quality, surface water flows and acquisition of other data as necessary.

Policy WR 2.16

Develop and maintain a publicly-available system to report groundwater levels on a timely basis.

SURFACE WATER PROTECTION AND MANAGEMENT

GOAL WR-3
Achieve no net loss of ecological functions and processes necessary to sustain *aquatic resources* including loss that may result from cumulative impacts over time.

Over recent decades awareness has grown of the importance of preserving and protecting *aquatic resources*. *Aquatic resources* have a number of important ecological functions, processes and values. These functions vary but include providing water quality protection, flood plain control, shoreline stabilization, contributions to *groundwater* and stream flows, and wildlife and fisheries habitat. *Aquatic resources* also have values as natural areas providing aesthetic, recreational and educational opportunities that *should* be preserved for future generations.

Policy WR 3.1

Development in regulated aquatic *critical areas* or their associated water quality buffers shall not be allowed unless application of *development regulation*s would deny any reasonable use of property. In such cases, minimize the allowed use and associated impacts, to maximize environmental protection.

Policy WR 3.2

Require that vegetated buffers be maintained between proposed development and the aquatic resource in order to protect the functions and values of such systems. Restore degraded buffers to enhance their function. Allow reductions in vegetated buffers only in areas where such reductions, if consistently applied, would not result in significant cumulative impacts to *aquatic resources* and *fish and wildlife habitat*.

Policy WR 3.3

Require that buffers be retained in their natural condition wherever possible while allowing for appropriate maintenance. Where buffer disturbance has occurred, require re-vegetation with appropriate species, with a preference for native species, to restore the buffers' protective values.

Vegetated buffers facilitate infiltration and maintenance of stable water temperatures, provide the biological functions of flood storage, water quality protection and *groundwater recharge*, reduce amount and velocity of run-off, and provide for wildlife habitat.

Policy WR 3.4

Ensure that development activities are conducted so that *aquatic resources* and natural drainage systems are maintained and water quality and quantity are protected.

Policy WR 3.5

Prior to any clearing, grading or construction on a site, all *wetland*s, *streams* and buffer areas are to be specifically identified and accurately located in the field in order to protect these areas during development.

Policy WR 3.6

Herbicides and pesticides approved for use near aquatic resources may only be used in aquatic resource areas and buffers when applied by licensed applicators.

Policy WR 3.7

Prohibit access to aquatic *critical areas* by *farm* animals. Require a *farm* management plan for agricultural activities within proximity of *aquatic resources* addressing water quality and other natural resource protection.

Policy WR 3.8

Require mitigation to compensate for unavoidable impacts to aquatic *critical areas*. Mitigation *should* be designed to achieve no net loss in functions and processes of *aquatic resources*.

Policy WR 3.9

Promote *watershed*-based mitigation to meet federal regulations, improve mitigation success and better preserve the ecological function of the island's *watersheds*.

Policy WR 3.10

Work with state and local health departments to evaluate the merits of new technologies such as grey water capture, package treatment plants and composting toilets as alternatives to septic and sewer systems.

Policy WR 3.11

Consider the impacts of *climate change* and ocean acidification when developing regulations or approving capital projects related to *aquatic resources* including marine nearshore, *wetlands*, *streams*, lakes, creeks, associated vegetated areas and *frequently flooded areas*.

Policy WR 3.12

Stream relocation will only be allowed where relocation would result in improved stream ecosystem function.

Policy WR 3.13

Degraded channels and banks *should* be rehabilitated by various methods (e.g., culvert replacement, volunteer efforts, public programs or as offsetting mitigation for new development) to restore the natural function of the riparian habitat for fish and wildlife.

Policy WR 3.14

Protect, preserve and enhance fish and wildlife habitat and adjacent riparian areas to ensure sustainable populations of resident aquatic life.

Policy WR 3.15

Require the construction of public facilities to avoid encroachment into and disturbances of *aquatic resources*.

Policy WR 3.16

Ensure a comprehensive program of surface water inventory, data gathering and analysis. The program *shall* include monitoring and assessment of physical, chemical and biological health of surface water ecosystems to include *streams*, ephemeral *streams*, lakes, *wetland*s and marine waters. This may include water, flow, sediment, habitat, pollutants, submerged aquatic vegetation, fish and shellfish tissue, aquatic species diversity and other ecosystem health indicators.

Policy WR 3.17

Support a community-wide program to educate Island residents about alternatives to using and disposing of herbicides, pesticides, and other household chemicals, to reduce impacts to marine shoreline areas, wetlands, streams, and other environmentally sensitive areas.

Policy WR 3.18

Promote and support volunteer or community-driven restoration projects.

STORMWATER PROTECTION AND MANAGEMENT

GOAL WR-4

Rather than capture and carry stormwater away as a waste stream, protect it from pollutants and retain it on site to replenish *aquifers* and maintain *wetlands* and natural stream flows, preserving or mimicking the natural water cycle to the maximum extent practicable.

Policy WR 4.1

Comply with all requirements of the City's National Pollutant Discharge Elimination System Phase II Municipal *Stormwater* Permit (NPDES Permit).

Policy WR 4.2

Provide ongoing opportunities for the public to participate in the decision-making process involving the development, implementation and update of the City's *Stormwater* Management Program through advisory councils, public hearings, and *watershed* committees.

Policy WR 4.3

Improve and maintain an education and outreach program designed to reduce or eliminate behaviors and practices that cause or contribute to adverse *stormwater* impacts and encourage the public to participate in stewardship activities.

Policy WR 4.4

Identify and eliminate sources of pollutants to the City's *stormwater* drainage system through proactive field screening techniques such as effluent monitoring, system inspections and cleaning, and commercial and industrial business inspection, and through the enforcement of the City's Illicit Discharge Detection and Elimination ordinance.

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Policy WR 4.5

Ensure development of and adherence to required public and private *stormwater* pollution prevention plans for public facilities, construction sites and commercial and industrial *land use*. Encourage the use of such plans where not specifically required.

Policy WR 4.6

Ensure development of and adherence to erosion and sediment control plans on all construction and development sites of any size.

Policy WR 4.7

Develop and actively enforce a strong *low impact development* (*LID*) ordinance to require any and all *LID* methods and practices for new development and redevelopment to the maximum extent practicable and reasonable.

Policy WR 4.8

Prioritize *LID*-based retrofit of public and private *stormwater* drainage systems and built assets through the inventory, management and fiscal planning process.

Policy WR 4.9

Incentivize *LID* retrofit of current built environment. **Policy WR 4.10**

Use *watershed* and basin plans to reduce *stormwater* impacts and *non-point source pollution*.
Policy WR 4.11

Comply with all requirements specifically identified by the City's permit for any Total Maximum Daily Load (TMDL) in which the City is a stakeholder.

Policy WR 4.12

Conduct effectiveness monitoring and assessments to continue to adaptively manage *stormwater* to ensure optimal protection.

RESIDENTIAL ON-SITE SEWAGE SYSTEMS

GOAL WR-5

Ensure that sewage is collected, treated and disposed of properly to prevent public health hazards and pollution of *groundwater*, Island surface water and the waters of Puget Sound.

Policy WR 5.1

Regulations and procedures of the Washington State Department of Health and the Kitsap Public Health District apply to all on-site disposal systems. Coordinate with these agencies to assure regular inspection, maintenance and repair of all *sanitary sewer* and on-site systems located on the Island.

Policy WR 5.2

Request notification of all waivers or variances of Kitsap Public Health District requirements such as modification of setbacks, vertical separation, minimum lot size, reserve drainfield, etc., prior to issuance and subsequent modifications by the Kitsap Public Health District of an approved Building Site Application.

Policy WR 5.3

Allow alternative systems such as sand filters, aerobic treatment, composting toilets and living-systems when approved by the Kitsap Public Health District.

Policy WR 5.4

Require coordination between the on-site septic and *storm drain*age disposal systems designs to ensure the proper functioning of both systems.

Policy WR 5.5

Assist the Kitsap Public Health District in developing a program to require proper maintenance of all on-site waste disposal systems in order to reduce public health hazards and pollution. This program *shall* include periodic system inspection and pumping when necessary.

Policy WR 5.6

Work with the Kitsap Public Health District on a collaborative program to fund and pursue grants or low-cost loans for low and moderate-income *household*s to repair failed septic systems. Incentivize maintenance, repair and replacement of systems for any income level.

Policy WR 5.7

Allow on-site waste disposal systems serving more than one *household* only with assurance of proper design, operation, management and approval from the Kitsap Public Health District.

Policy WR 5.8

Provide the service of operation and maintenance management for approved large on-site *sanitary sewer* systems or community *sanitary sewer* systems in coordination with the Kitsap Public Health District.

Policy WR 5.9

Support the Kitsap Public Health District in maintaining and improving a public education program to foster proper construction, operation and maintenance of on-site septic systems.

Policy WR 5.10

Support the Kitsap Public Health District in developing and maintaining an ongoing inventory of existing on-site disposal systems to provide needed information for future studies.

PUBLIC EDUCATION AND OUTREACH

GOAL WR-6

The City, in concert with federal, state and local governments, public water purveyors, watershed councils, non-profits, citizens and other appropriate entities will continue to improve and implement comprehensive public education and outreach program to promote protection and management of all water resources.

Policy WR 6.1

Educate and inform the public about:

- • The purpose and importance of aquatic environments, their vulnerabilities and observed status and trends in ecological health and function;
- • Expected *climate change* impacts and how these will affect the Island's water resources and their beneficial uses;
- • The characteristics of the *aquifer* system, the Island's dependency upon it and its vulnerability to contamination (including seawater intrusion) and depletion;
- • The Environmental Protection Agency's Sole Source Aquifer Designation Program and what this designation means for the Island's *aquifer* system;
- • Wellhead protection and the critical importance of restricted chemical use or storage within the protection area around wells;
- • Critical *aquifer recharge areas* (or other special conservation areas) and the purpose they serve to the *aquifer* system;
- • How to report spills or illicit dumping of hazardous waste or other pollutants and how to access information about location and status of contaminated sites;
- • How to find information about their well and how to properly maintain it;
- • Methods to identify wastewater indoors and outdoors and practices to conserve water

such as native landscaping, xeriscaping and water use reduction or reuse;

- • Resources for streamside and shoreline landowners;
- • Water resources protection best management practices for commercial, industrial, residential, agricultural and other *land use*s to prevent or reduce pollution. These practices include but are not limited to, septic system maintenance, pet and livestock waste management, landscaping and gardening, *farm* plans, appropriate methods for use, storage and disposal of hazardous materials and other chemicals, on-site drainage system maintenance and automotive care.

Policy WR 6.2

Promote opportunities for citizen stewardship and involvement.

Policy WR 6.3

Provide *LID* technical guidance and workshops to businesses and contractors working on the Island.

WATER RESOURCES IMPLEMENTATION

To implement the goals and policies in this Element, the City must take a number of actions, including adopting or amending regulations, creating outreach and educational programs, and staffing or other budgetary decisions. Listed following each action are several of the comprehensive plans policies that support that action.

HIGH PRIORITY ACTIONS

WR Action #1 Adopt *aquifer conservation zoning regulations* and innovative permit

review processes designed to protect the Island's surface and ground waters. Policy WR 1.4

Apply the policies in this Element together with the protection measures set by the City's Shoreline Master Program, *Critical Areas* Ordinance and any other environmental or water resources management ordinance adopted by the City and in compliance with county, State, and federal laws and regulations.

Policy WR 2.1

Recognize that the Island functions as an *aquifer recharge area*. *Low impact development techniques* are essential for maintaining aquifer recharge.

Policy WR 2.9

Recognizing that the Island *aquifer* system is a Sole Source *Aquifer* as designated by EPA, consider creation and application of one or more aquifer conservation zones for appropriate areas of the Island and institute an added level of development and re-development permit review to prevent or mitigate potential pollutant-generating activities or activities that could affect stormwater runoff and aquifer recharge associated with a proposed *land use*. The Island's aquifers are protected through critical area regulations and Revised Code of Washington (RCW) 36.70A.550.

Policy WR 4.7

Develop and actively enforce a strong Low Impact Development (LID) ordinance to require any and all *LID* methods and practices for new development and redevelopment to the maximum extent practicable and reasonable.

Policy LU 12.4

Protect *aquifer recharge* functions throughout the Island, all of which is an *aquifer recharge area*, through the application of *critical areas regulations,* Shoreline Master Program use regulations, *low impact development regulations*, and the wellhead protection regulations administered by the Kitsap Health District.

WR Action #2 Adopt an Island-wide Groundwater Management Plan. Take the actions necessary- capital improvements, code changes, etc.- to capture, clean and re-infiltrate as much stormwater as reasonably possible.

2016 COMPREHENSIVE PLAN WR-13 **WATER RESOURCES ELEMENT**

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Policy WR 2.7

Establish a stakeholder group to develop an Island-wide groundwater management plan and work with Kitsap Public Utility District to update the Kitsap County Coordinated Water System Plan.

WR Action #3 Incorporate *Low Impact Development* principles, goals and approaches into all land use and development codes.

NOTE: Same Action in Environmental Element

WR Action #4 Apply *adaptive management* to assure that land use on the Island will continue to be adequately served by the available water resources.

Policy WR 3.16

Ensure a comprehensive program of surface water inventory, data gathering and analysis. The program *shall* include monitoring and assessment of physical, chemical and biological health of surface water ecosystems to include *streams*, ephemeral *streams*, lakes, *wetland*s and marine waters. This may include water, flow, sediment, habitat, pollutants, submerged aquatic

vegetation, fish and shellfish tissue, aquatic species diversity and other ecosystem health indicators.

Policy WR 4.12

Conduct effectiveness monitoring and assessments to continue to adaptively manage *stormwater* to ensure optimal protection.

MEDIUM PRIORITY ACTIONS

WR Action #5 Launch a program of public education about how individual actions can

help protect the quality and quantity of the Island's surface and groundwaters. Policy WR 2.11

Develop a water conservation program for all water uses on the Island.

Policy WR 2.13

Develop a program that incentivizes and facilitates innovative methods for homeowners and business owners to use stormwater and grey water as approved by the Washington State Department of Health and the Kitsap Public Health District.

Policy WR 3.17

Support a community-wide program to educate Island residents about alternatives to using and disposing of herbicides, pesticides, and other household chemicals, to reduce impacts to marine shoreline areas, wetlands, streams, and other environmentally sensitive areas.

Policy WR 3.18

Promote and support volunteer or community-driven restoration projects.

Policy WR 6.2

Promote opportunities for citizen stewardship and involvement.

WR Action #6 Consider adopting seawater intrusion regulations in coordination with Kitsap County.

Policy WR 2.10

Retard seawater intrusion into our groundwater through the development and application of a comprehensive seawater intrusion prevention program.

OTHER PRIORITY ACTIONS

WR Action #7 Work with other jurisdictions and the environmental and development communities to promote programs and projects to protect the Island's surface and ground waters.

Policy WR 2.5

The City, in cooperation with the appropriate regulatory agencies (e.g., Washington State Department of Health and the Kitsap Public Health District) will institute new wellhead protection measures.

Policy WR 3.10

Work with state and local health departments to evaluate the merits of new technologies such as greywater capture, package treatment plants and composting toilets, as alternatives to septic and sewer systems.