

Developing a Wellhead Protection Plan

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Sun Vista/Sunlight Beach HOA

Presented to ERWOW Fall Conference

Topics

- Overview
- Wellhead Protection Program
 - Susceptibility Analysis
 - WHPA Delineation
 - Contaminant Sources
- Potential Concerns
 - Septic Tanks
 - Seawater Intrusion
- Summary

Sun Vista/Sunlight Beach HOA

- Class A system
- 163 hookups
- Two shallow wells
- Coastal aquifer
- Useless Bay drainage basin #4
- Critical aquifer recharge area
- Common Pool Resource - owned by patrons
- All-volunteer board



Rural

Rural Residential

Rural Center

Rural Forest

Rural Agriculture

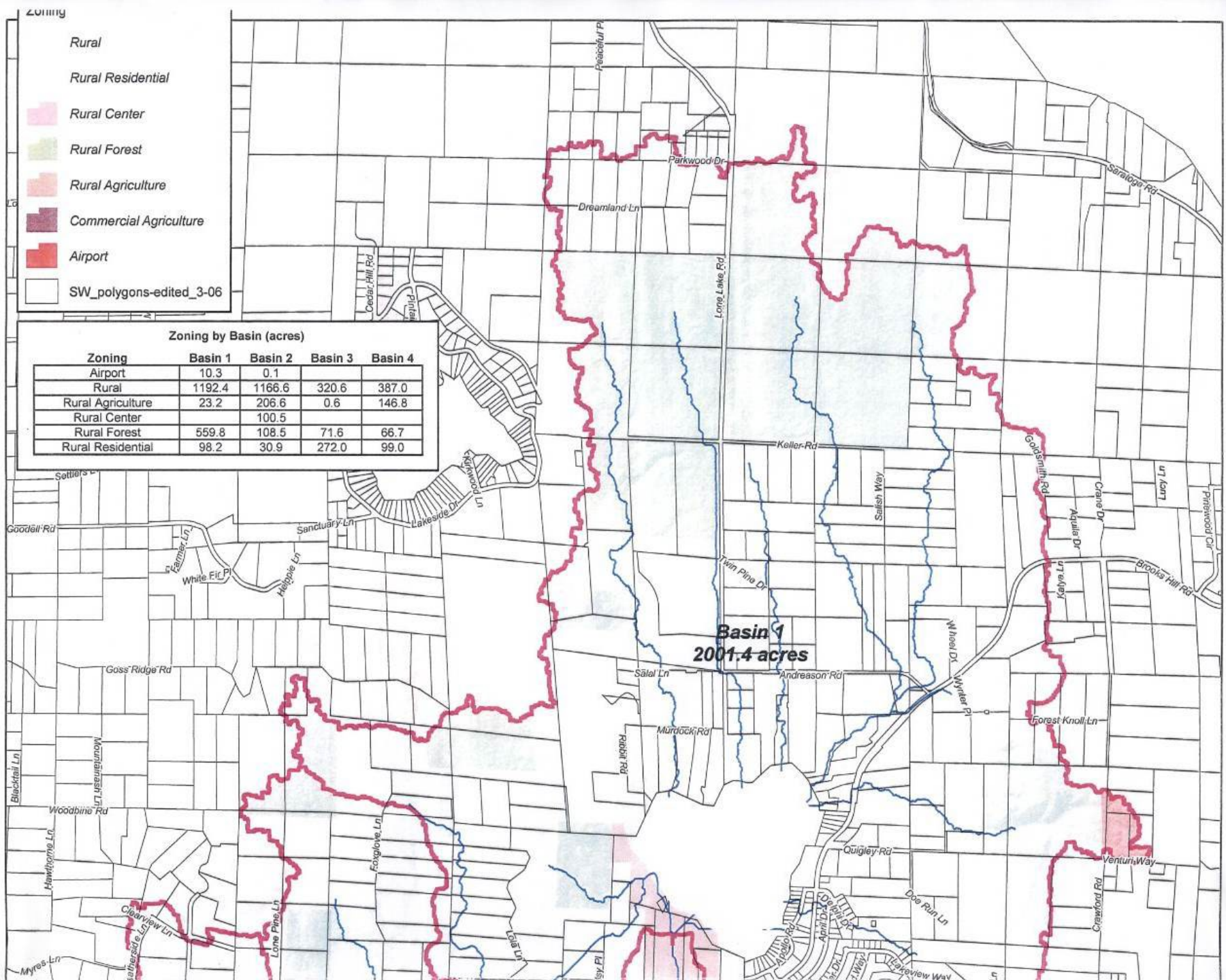
Commercial Agriculture

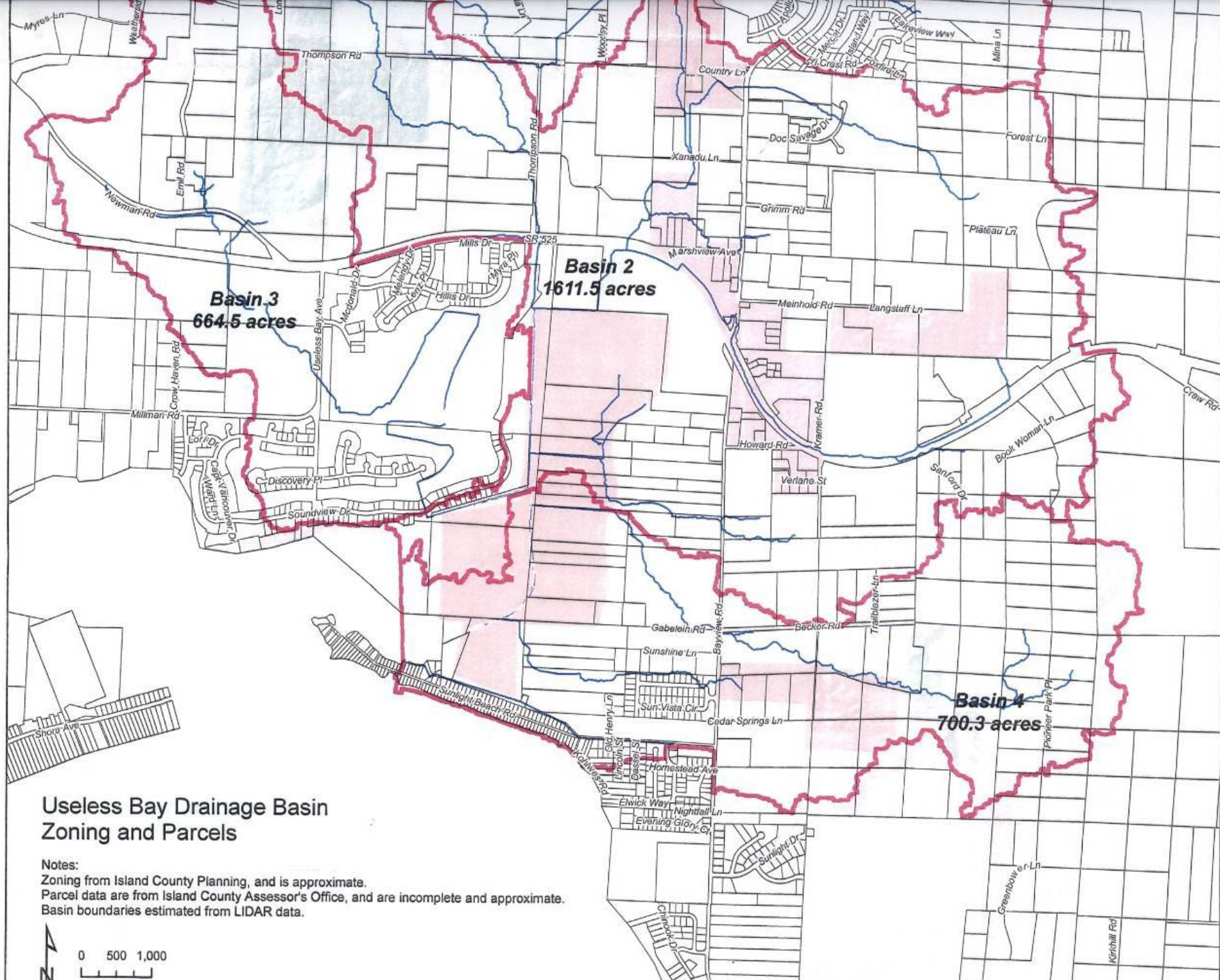
Airport

SW_polygons-edited_3-06

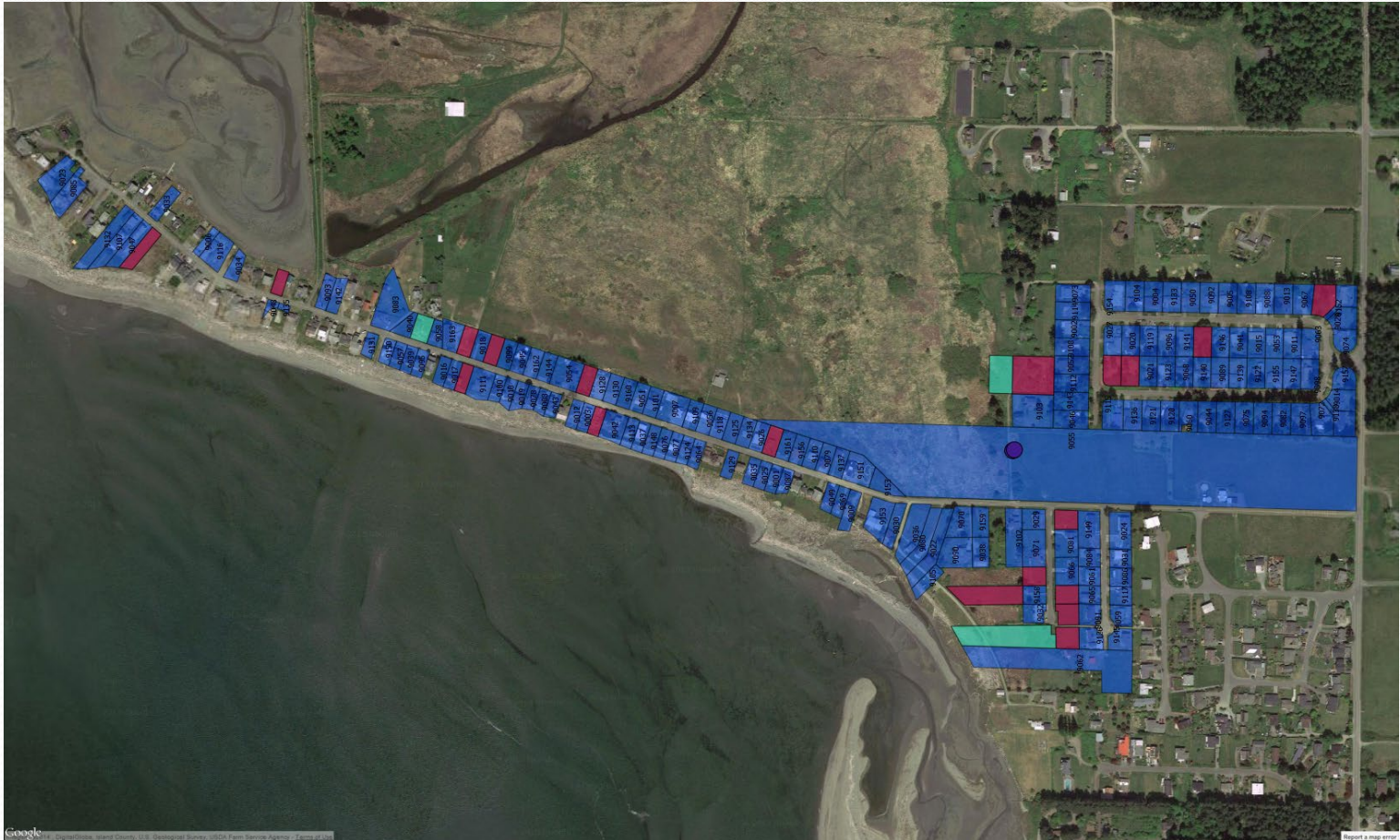
Zoning by Basin (acres)

Zoning	Basin 1	Basin 2	Basin 3	Basin 4
Airport	10.3	0.1		
Rural	1192.4	1166.6	320.6	387.0
Rural Agriculture	23.2	206.6	0.6	146.8
Rural Center		100.5		
Rural Forest	559.8	108.5	71.6	66.7
Rural Residential	98.2	30.9	272.0	99.0





Service Area and Well Site



Wellhead Protection Program

Roles and Responsibilities – Water System

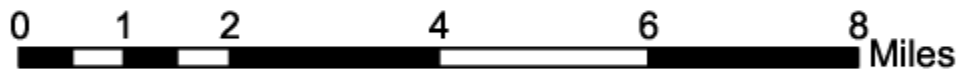
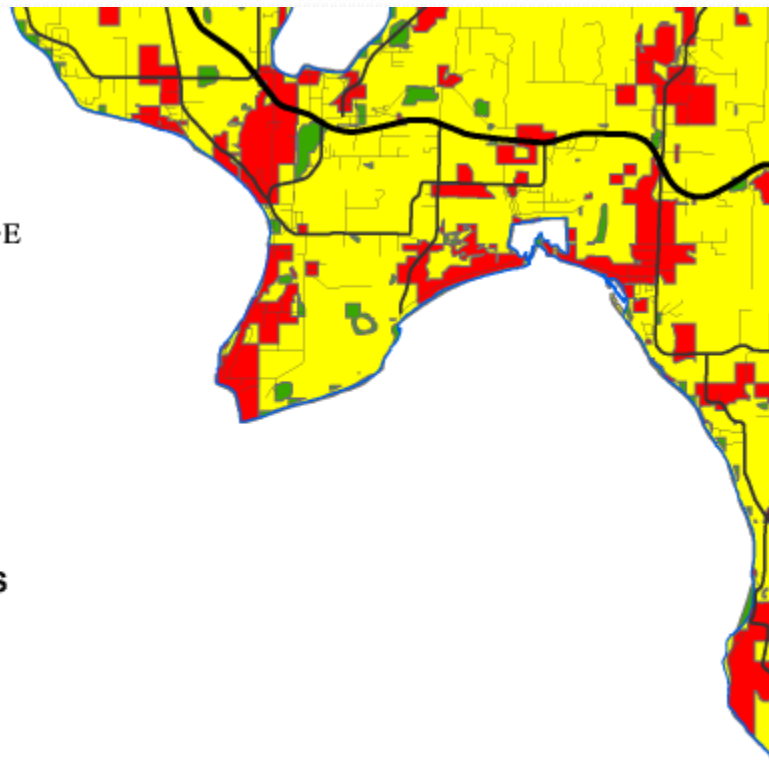
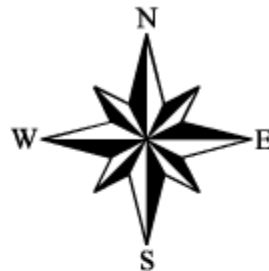
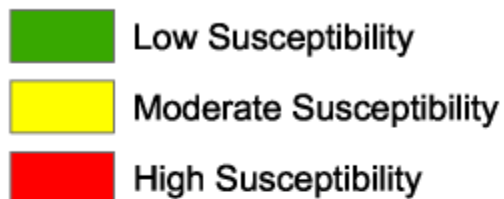
1. Susceptibility assessment
2. Wellhead Protection Area delineation
3. Inventory of contaminant sources
4. Notification to regulatory agencies
5. Notification to property owners
6. Contingency plan for potable water
7. Coordination with emergency responders

Susceptibility Assessment

- Shallow wells
- Septic systems
- Underground heating oil storage tanks
- Coastal aquifer

CARA Map

Aquifer Susceptibility

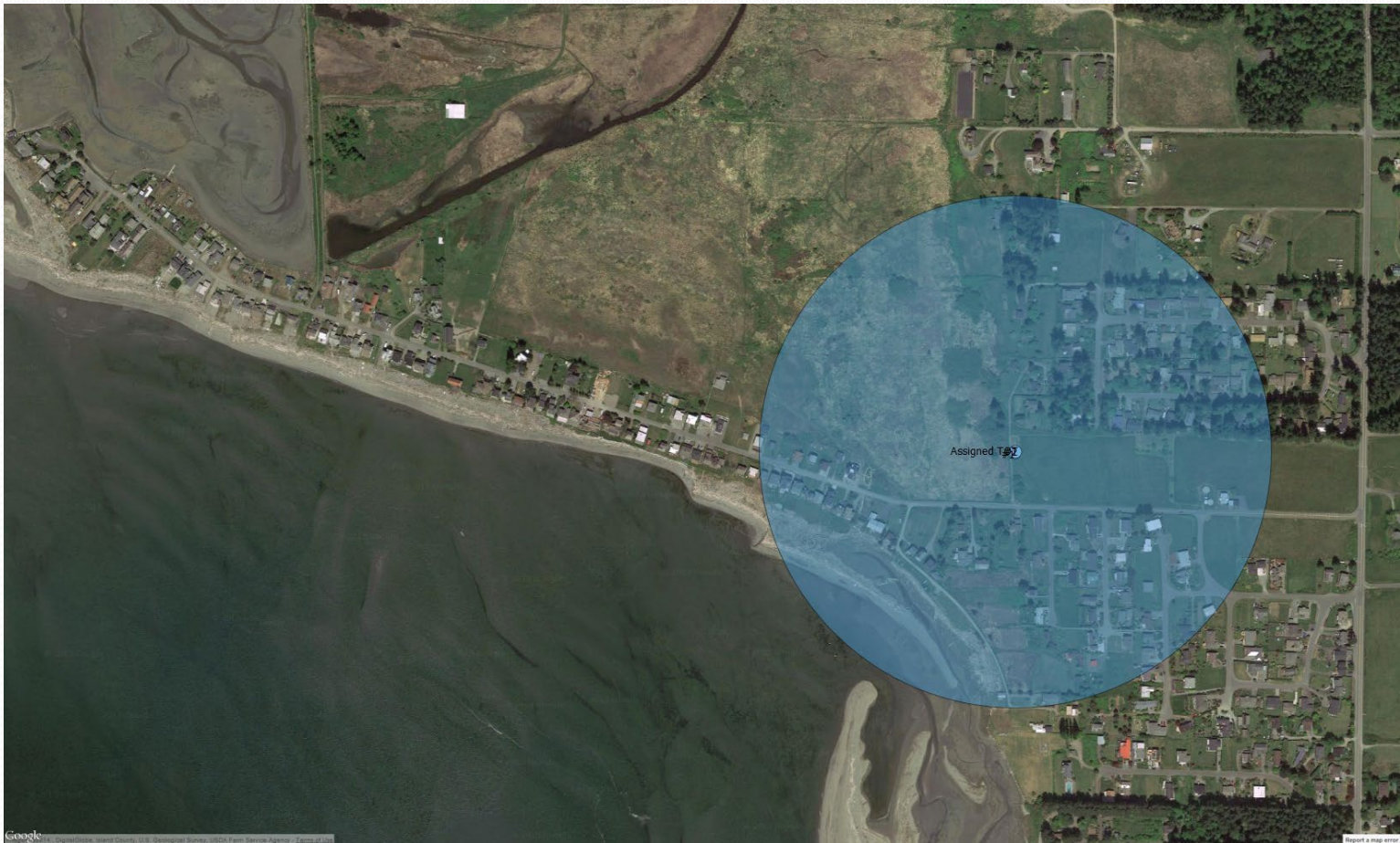


Island County Critical Aquifer Recharge Area Map

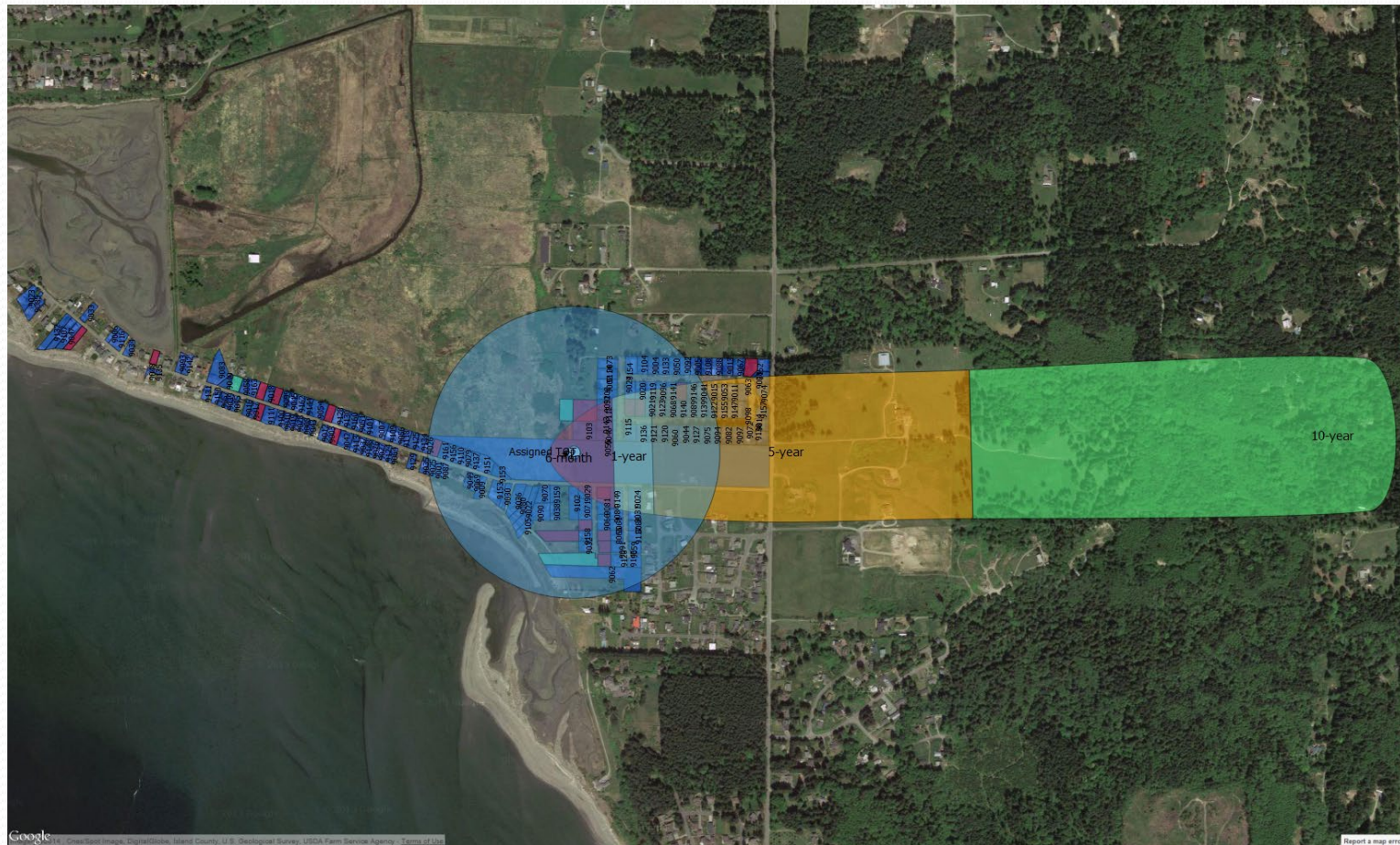
WHPA Delineation

- SWAP (Source Water Assessment Program) map shows simple radius
- Met criteria for non-circular zone of contribution
- Hired Golder Associates to carry out delineation
- Contributed data from level logging

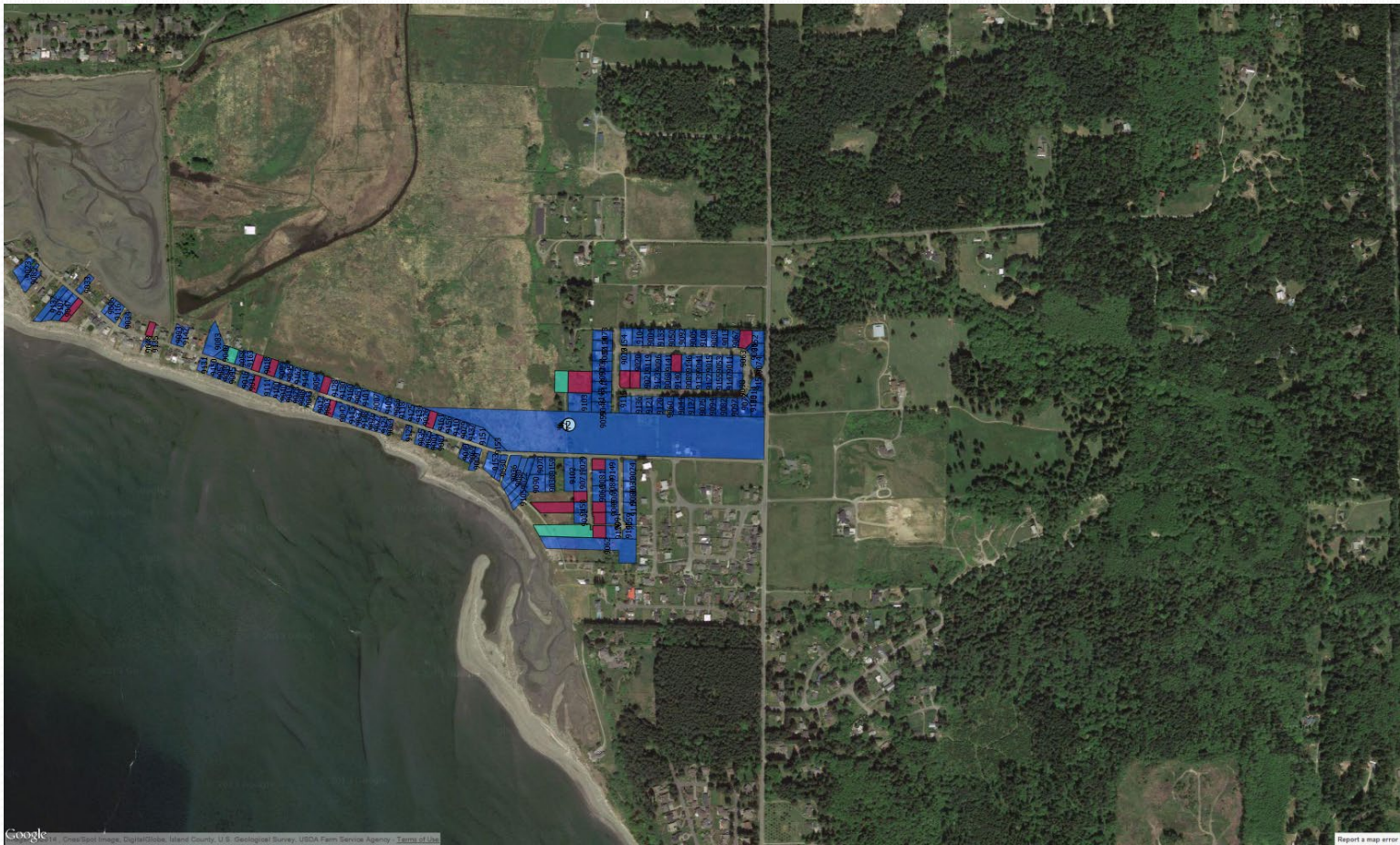
SWAP Map - Assigned TOT



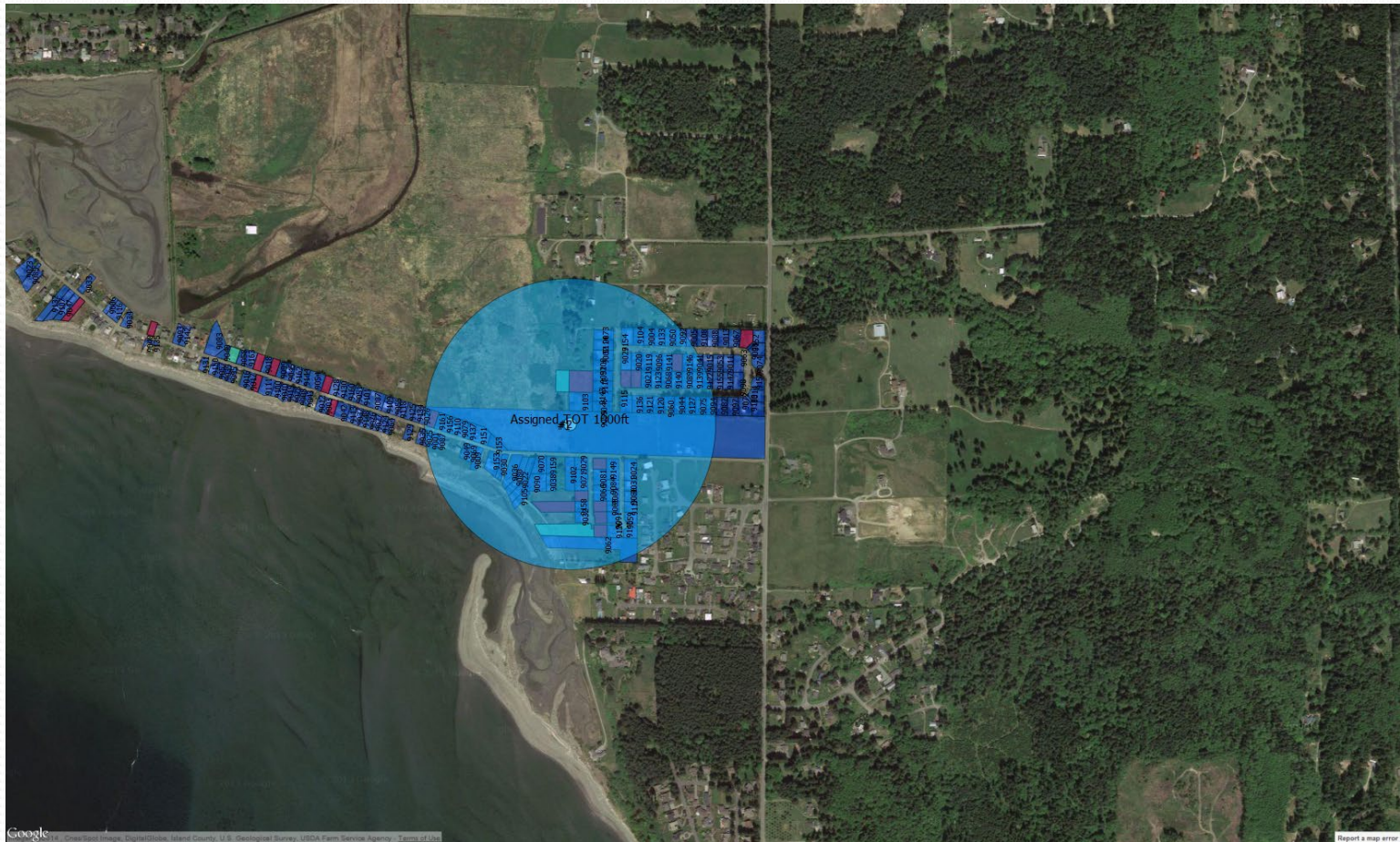
Service Area and WHPA



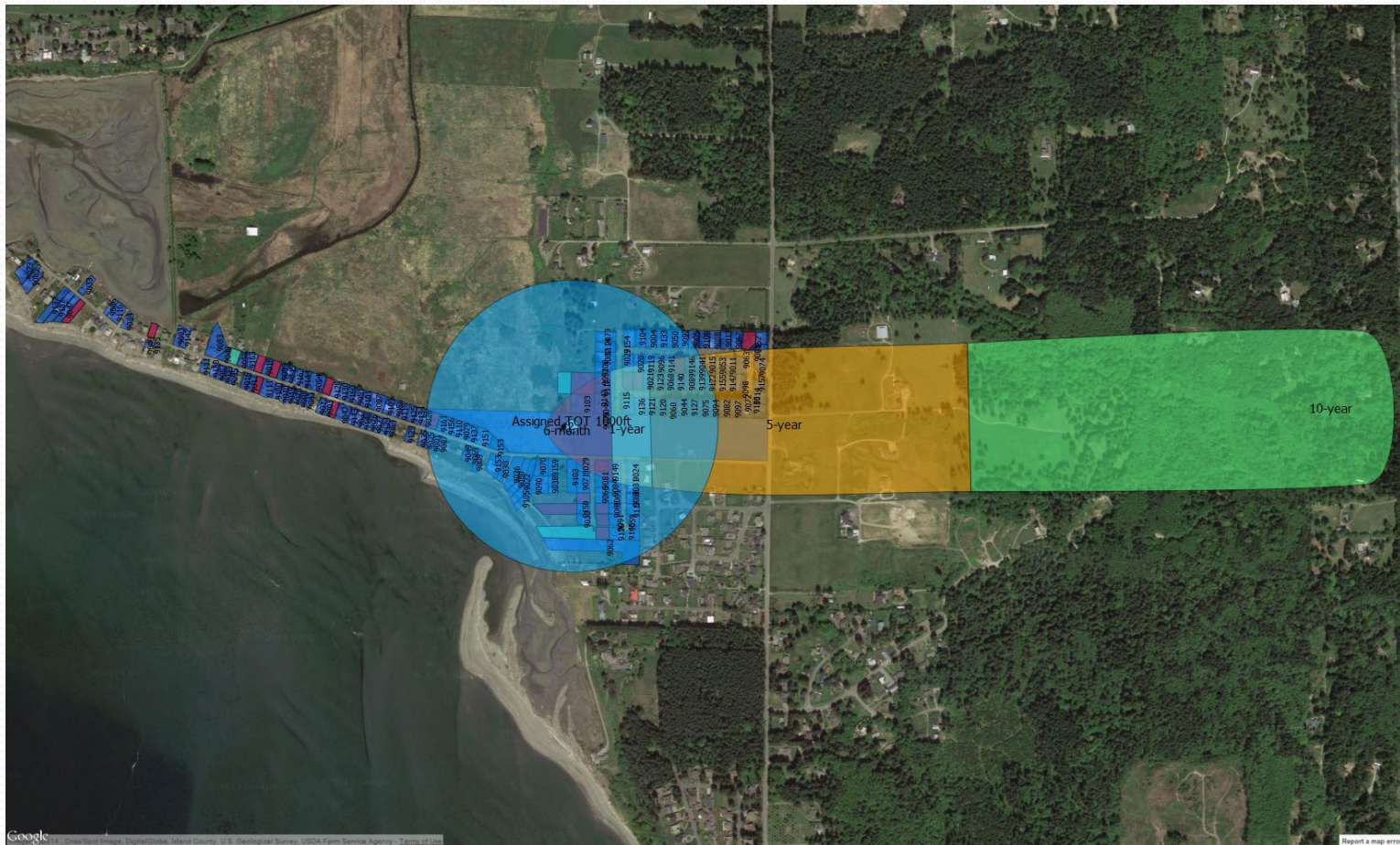
Service Area



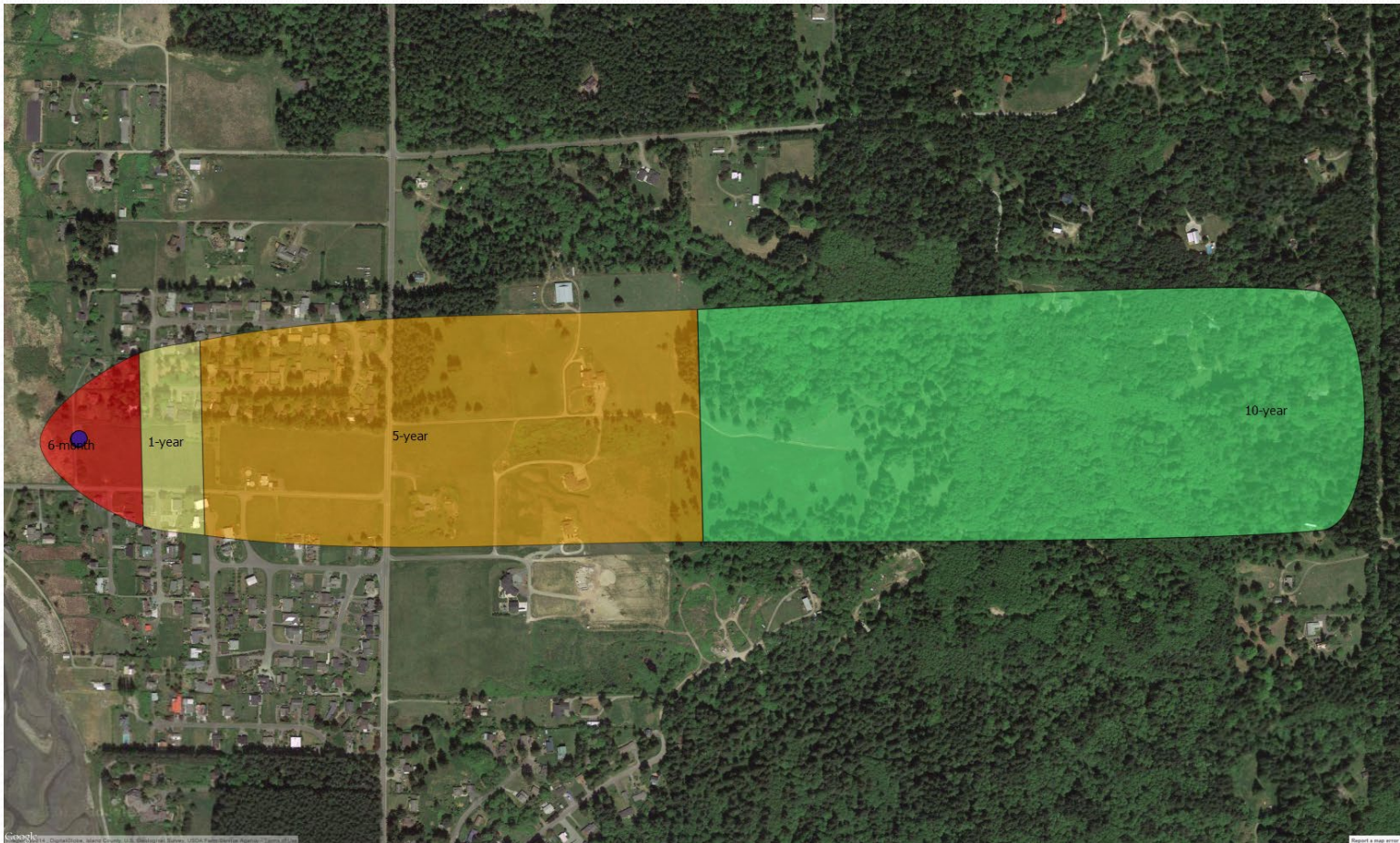
Service Area + SWAP



Service Area + SWAP + WHPA



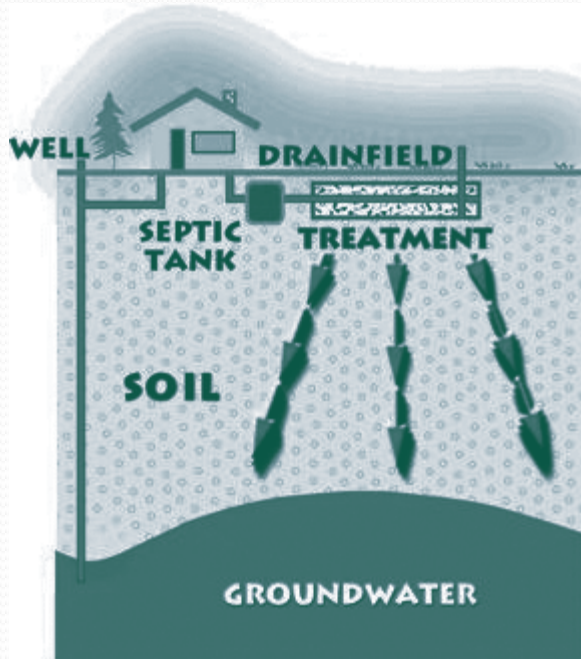
WHPA Delineation



Inventory of Contaminant Sources

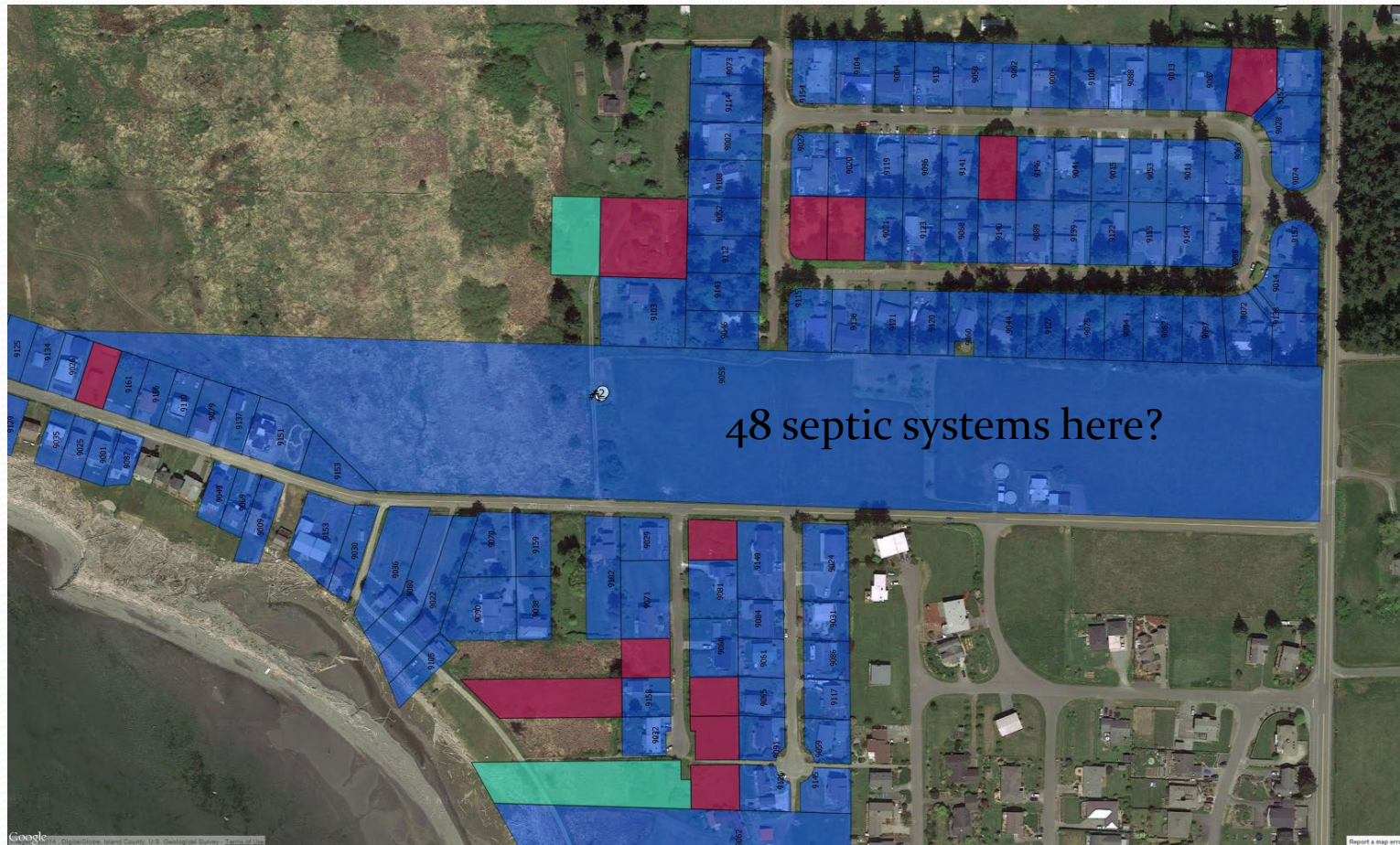
- EDR Summary Report
- None known within WHPA
- *Potential* sources
 - Septic tanks
 - Oil storage tanks
 - Seawater intrusion

Septic Tanks



- Potential development of hillside above well
- 48 additional septic systems?
- DOH tool for nitrate balance

Septic Tanks



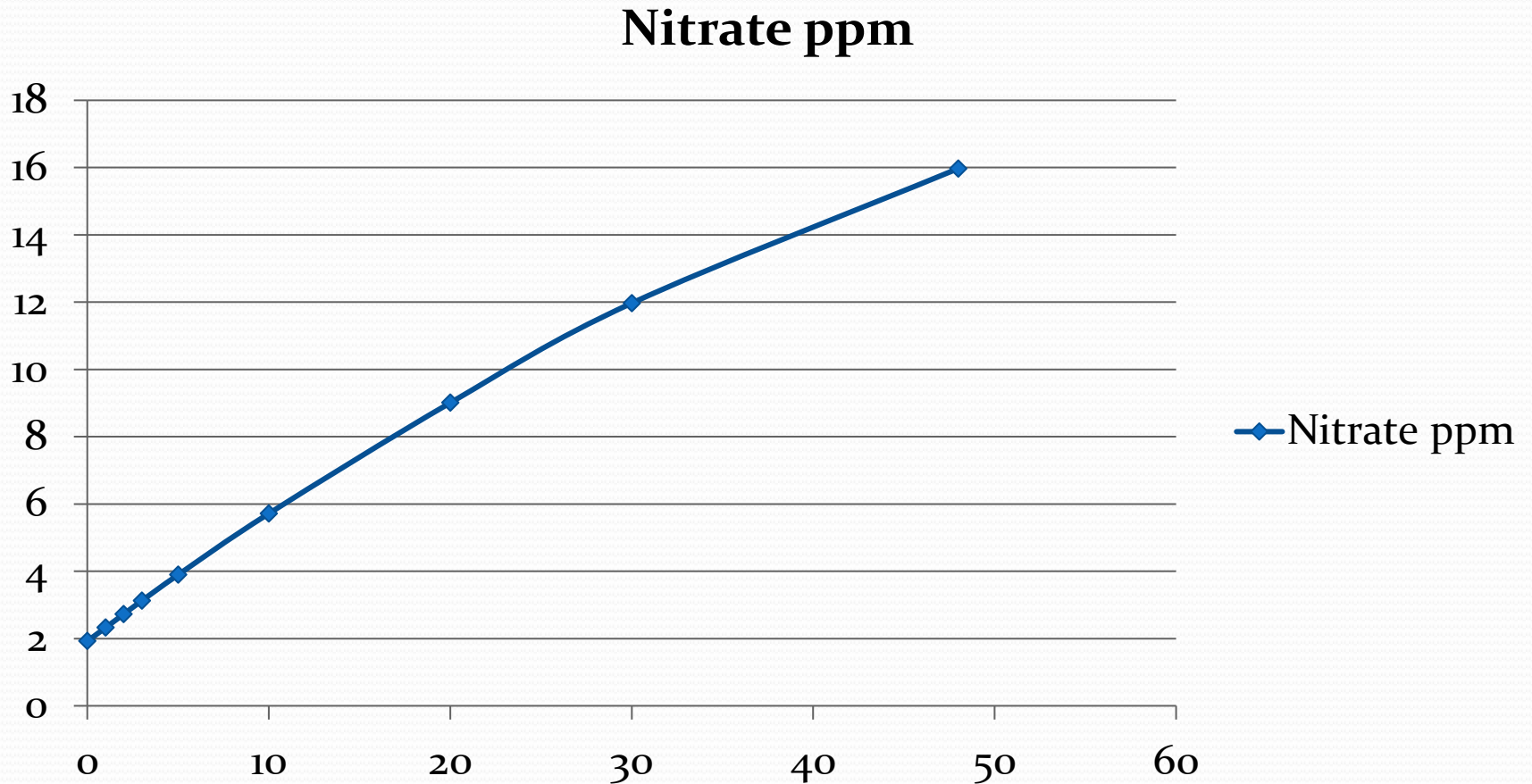
Washington Department of Health

Level 1 Nitrate Balance for Large On-Site Sewage Systems

Effect of addition of 48 septic systems on hillside above wells

Input Values		Factor	Units	Values	Instructions	Information Source
Nitrate concentration in precipitation		N_R	mg/l as N	0.24	Default	Default
Total nitrogen concentration in wastewater		N_W	mg/l	60	Default - residential strength	Default
Soil denitrification		d	unitless	0.1	Default	Default
Aquifer thickness		b	ft	20	Default or aquifer thickness if known	WHP
Drainfield area		A_D	ft ²	385,000	Primary drainfield area	Lot width*length
Distance from drainfield to property boundary		D_{pb}	ft	100	Measure in direction of GW flow	Sanitary control area
Aquifer width		W_A	ft	275	Perpendicular to GW flow	Lot width
Aquifer hydraulic conductivity		K	ft/day	400	Measured or literature value	WHP (T/b)
Hydraulic gradient		i	ft/ft	0.002	If unknown, use 0.001	WHP
Recharge		R	in/yr	3.00	Recharge will be a % of ppt	USGS Recharge map
Nitrate concentration of upgradient ground water		N_B	mg/l	2	Prefer sampling data	Current background
Wastewater volume		V_W	gpd	12,960	Design flows or measured volume	lots*gpd/lot
Output Values						
Groundwater nitrate value		N_{GW}	mg/l as N	16.01	Point of Compliance (POC)	
Groundwater nitrate value		$N_{GW\ ALT}$	mg/l as N	15.97	Alternative POC	

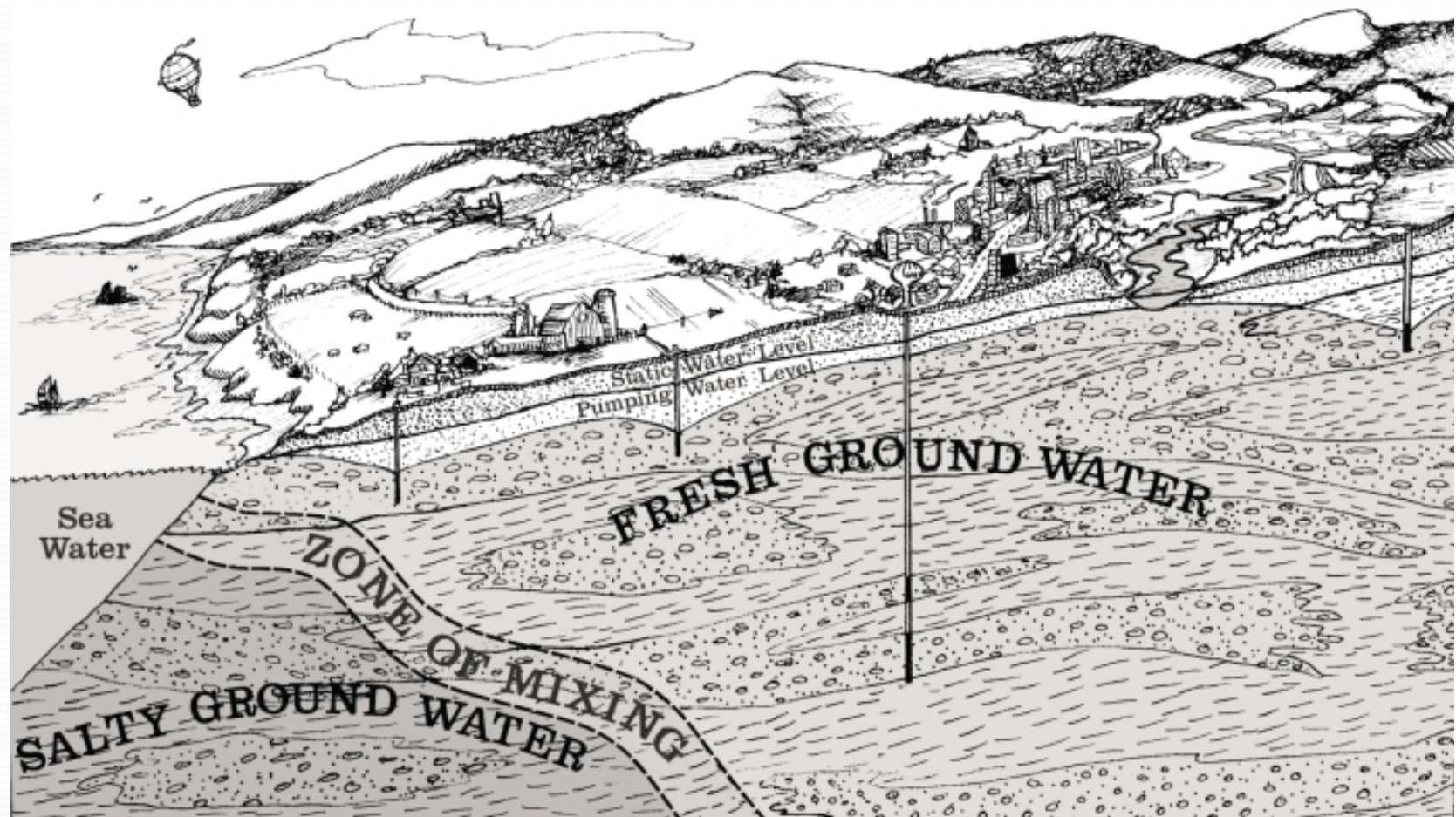
Nitrate ppm vs Number of Septics



Potential Development

- Installation of 48 septic tanks would raise nitrate to 16 ppm (currently 2 ppm)
- Limit is 10 ppm
- Increase of 2 ppm is a red flag
- Max number of new units to keep increase below 2 ppm is <5

Seawater Intrusion



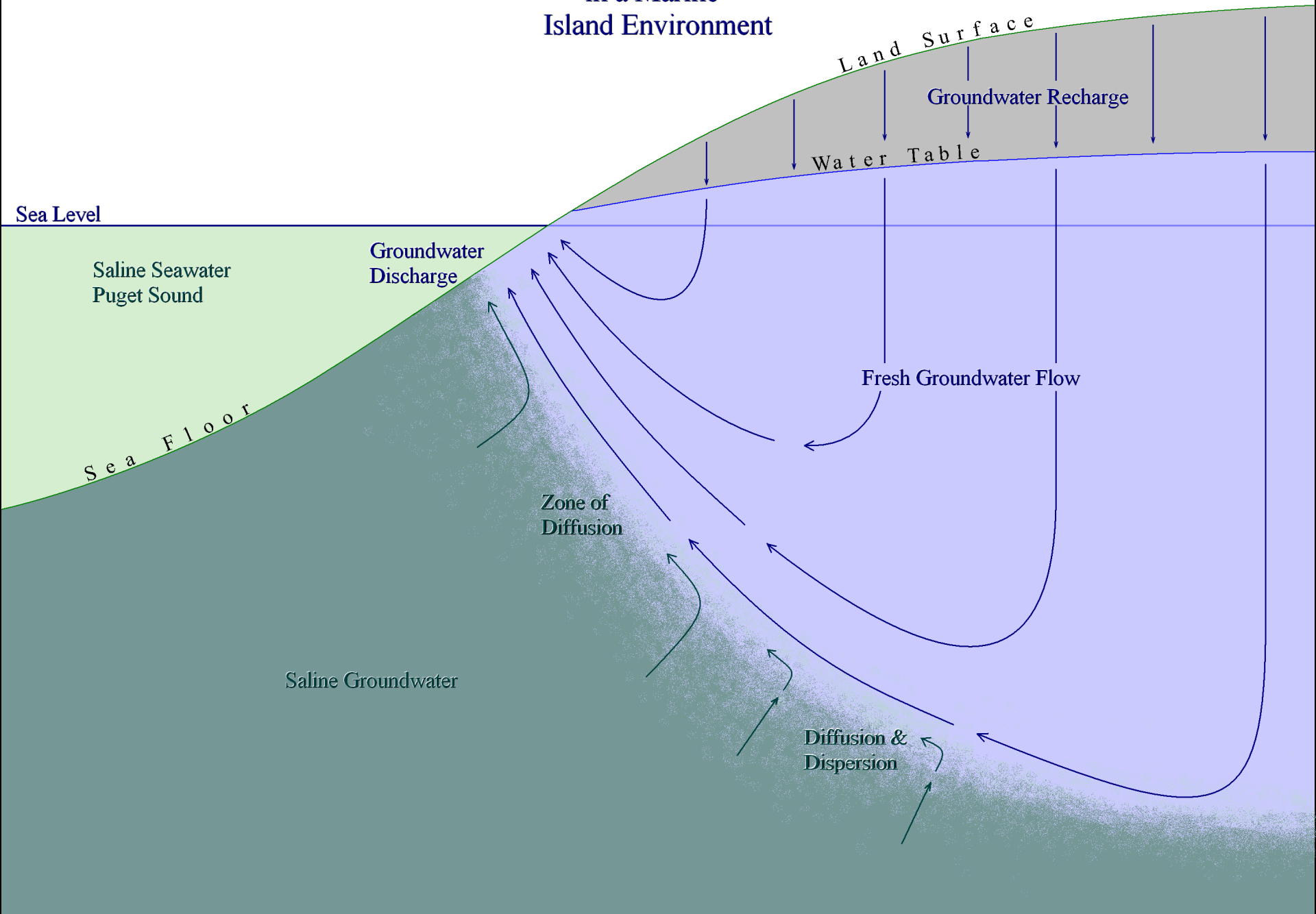
Seawater Intrusion



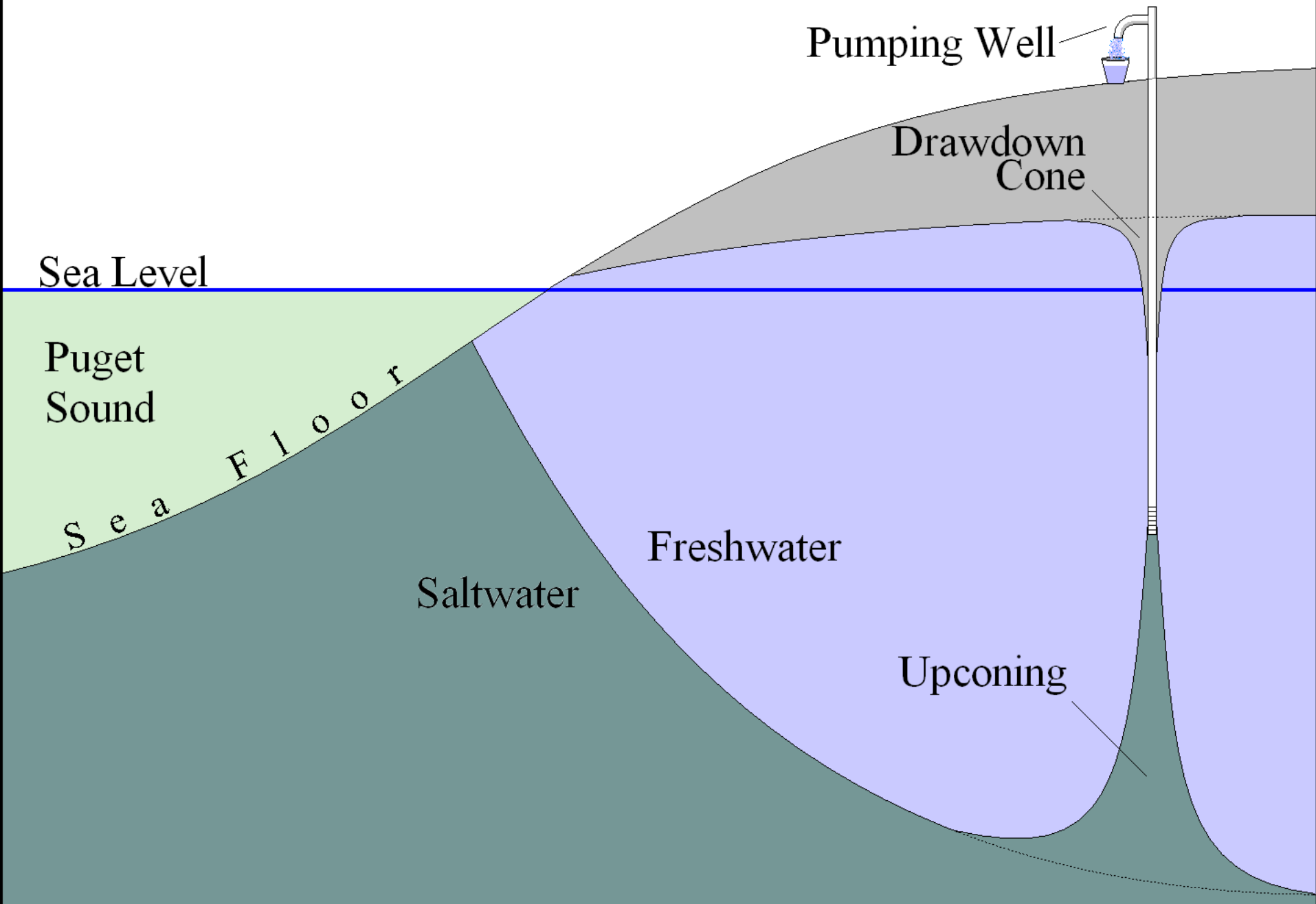
Seawater Intrusion Risk Factors

- Low elevation ~ 20 ft
- Screens are at or below sea level
- Drawdown cone goes below sea level
- 600 ft from salt water – separated by wet or low land
- Adjacent to wetland
- Chloride has increased from 5 to 10 ppm since 1990s
- DD #1 pumping project

Groundwater Flow in a Marine Island Environment



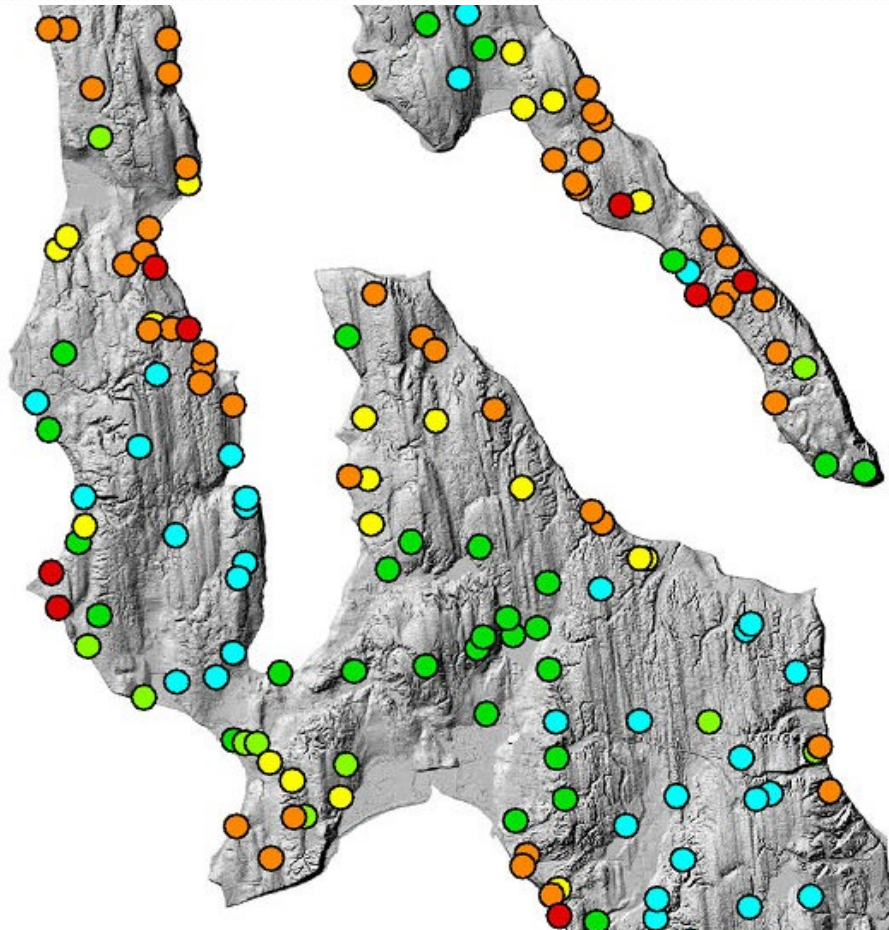
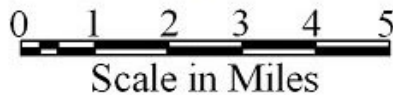
Drawdown and Upconing



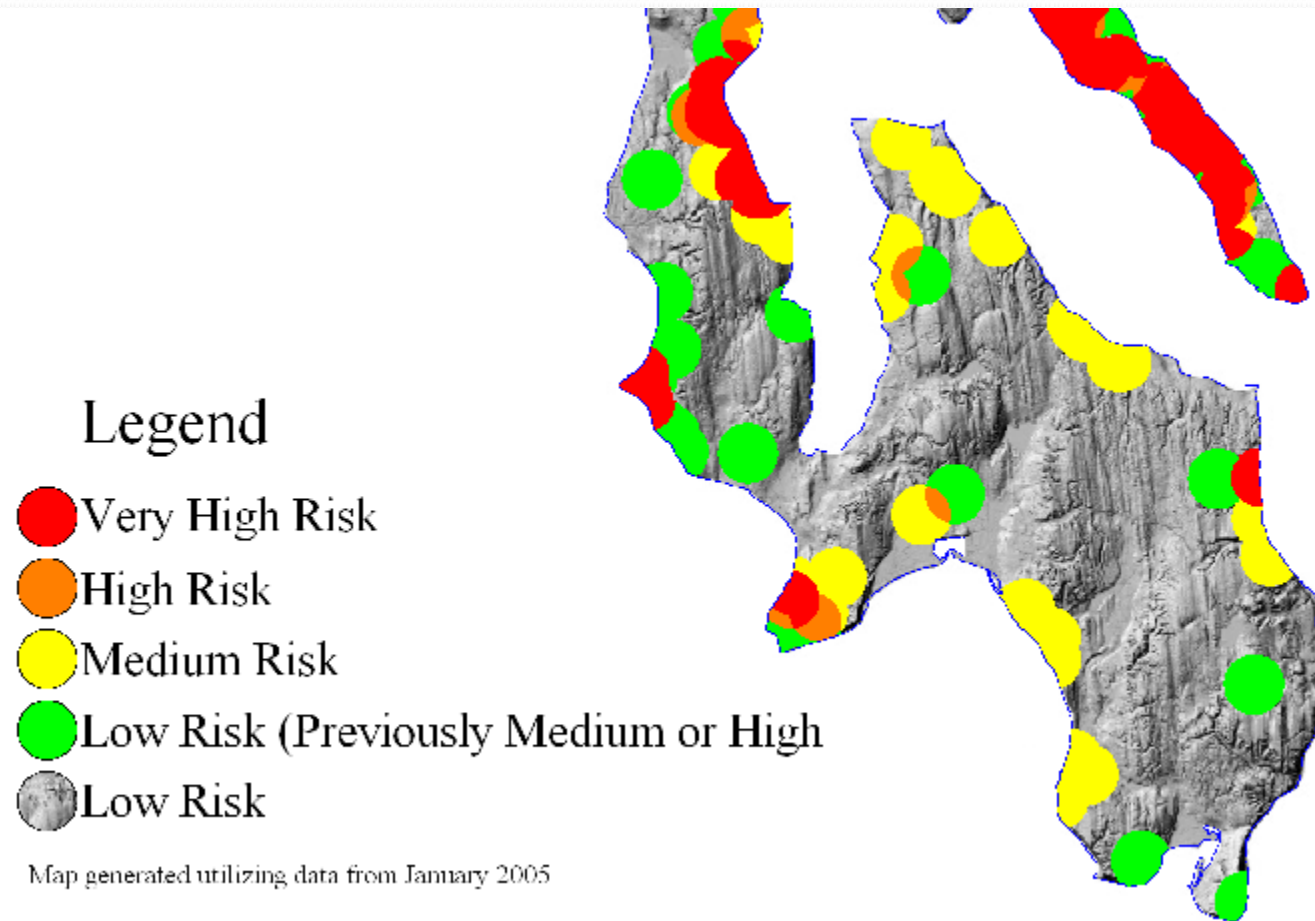
Water Level Elevation

Water Level Elevation

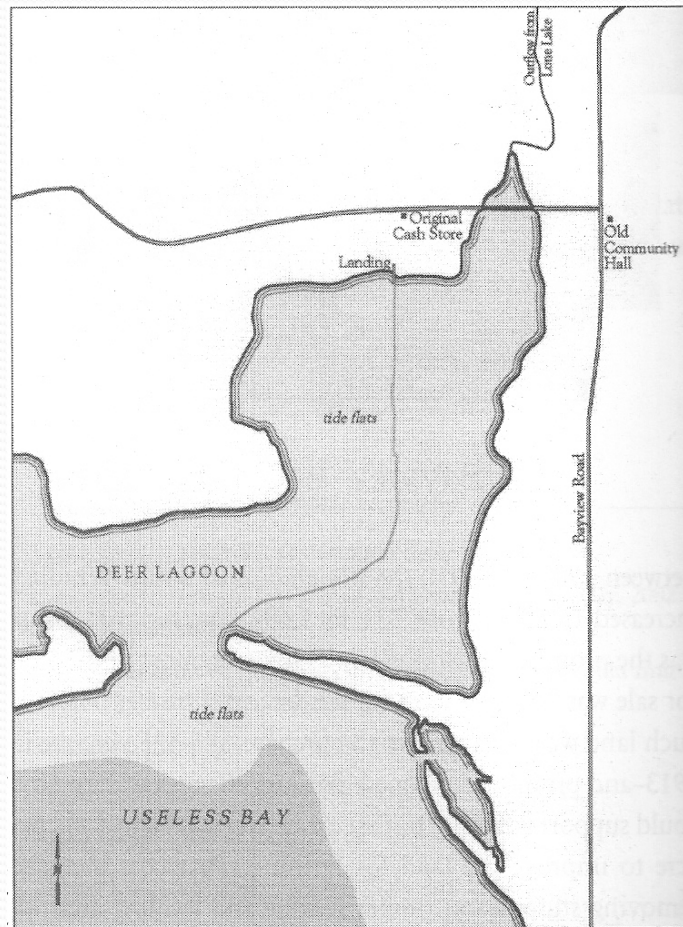
- Very High (> 20)
 - High (8 to 20)
 - Medium High (6 to 8)
 - Medium (4 to 6)
 - Low (1 to 4)
 - Very Low (< 1)
- Feet Above Mean Tide*



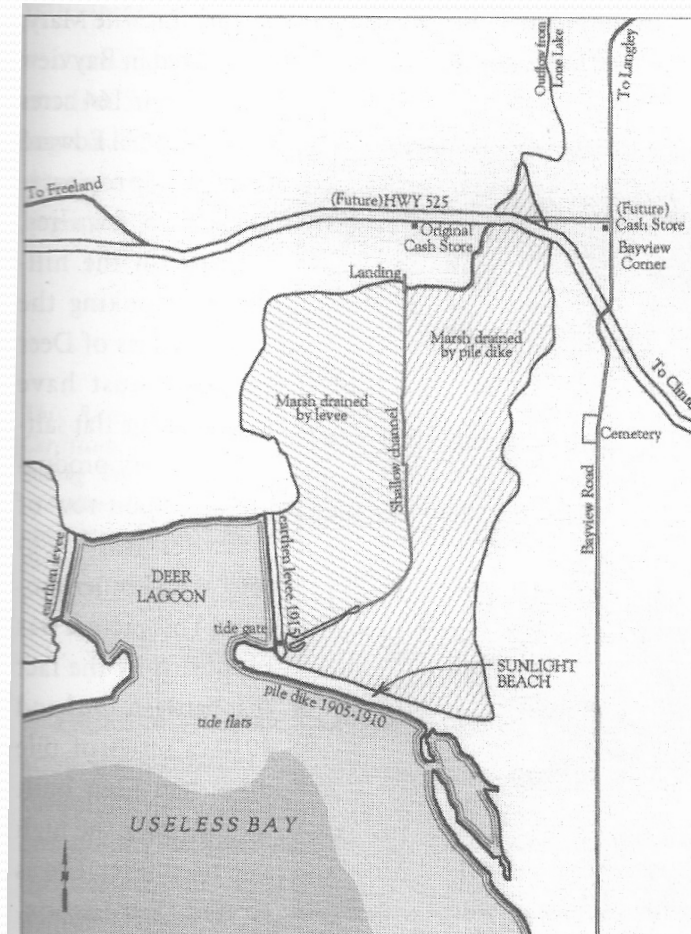
Revised Seawater Intrusion Policy 'Circle Map'



Diking District #1 1900



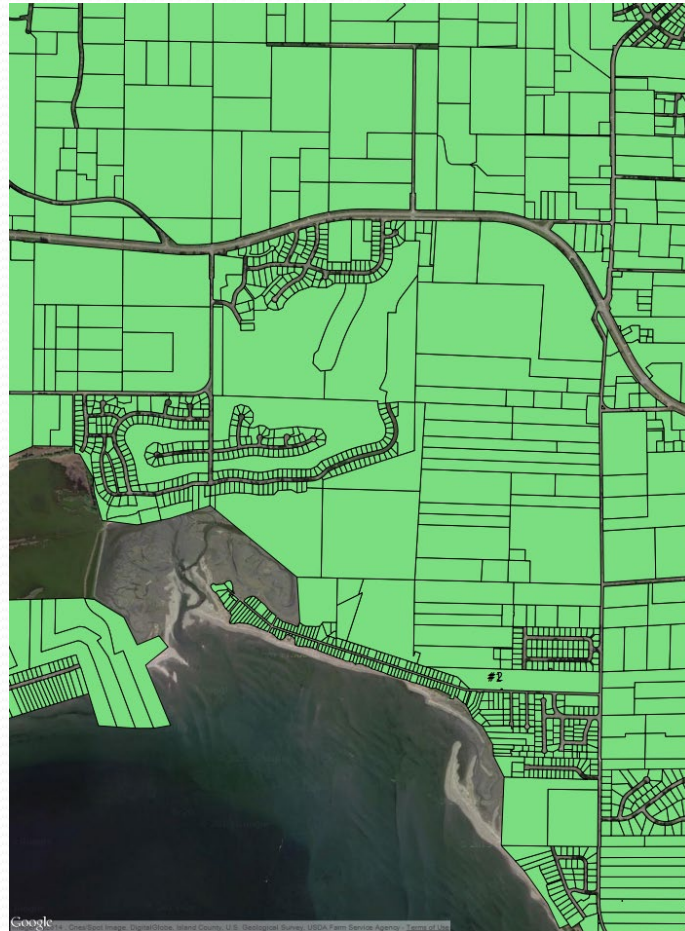
Diking District #1 1915



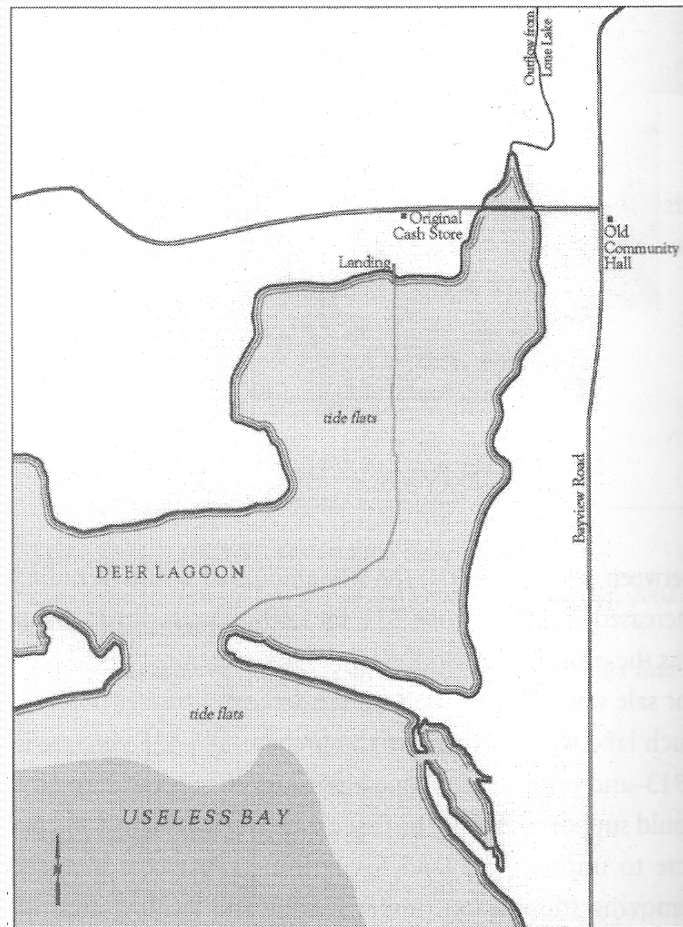
Diking District #1 2014



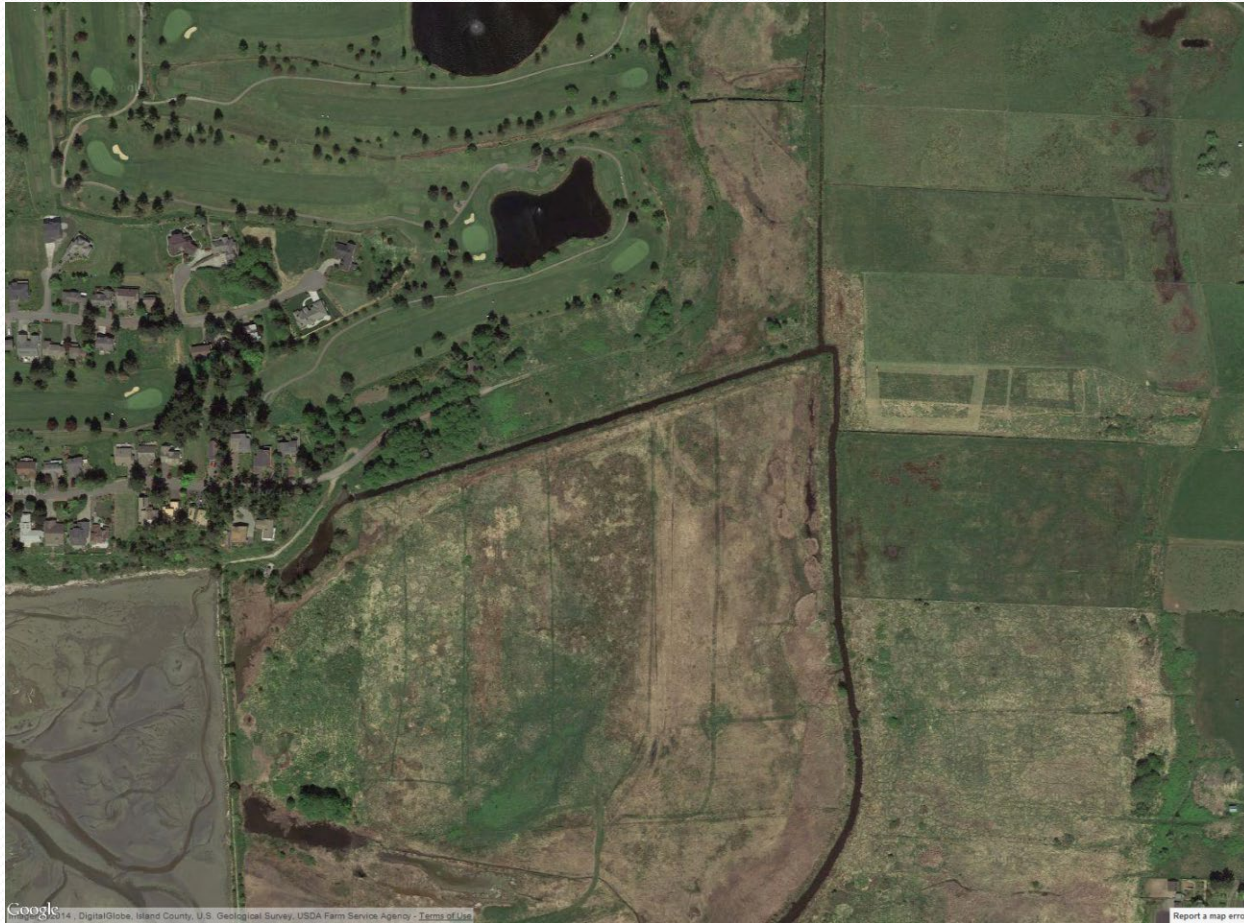
Diking District #1 20??



Diking District #1 1900



DD #1 Pumping Project

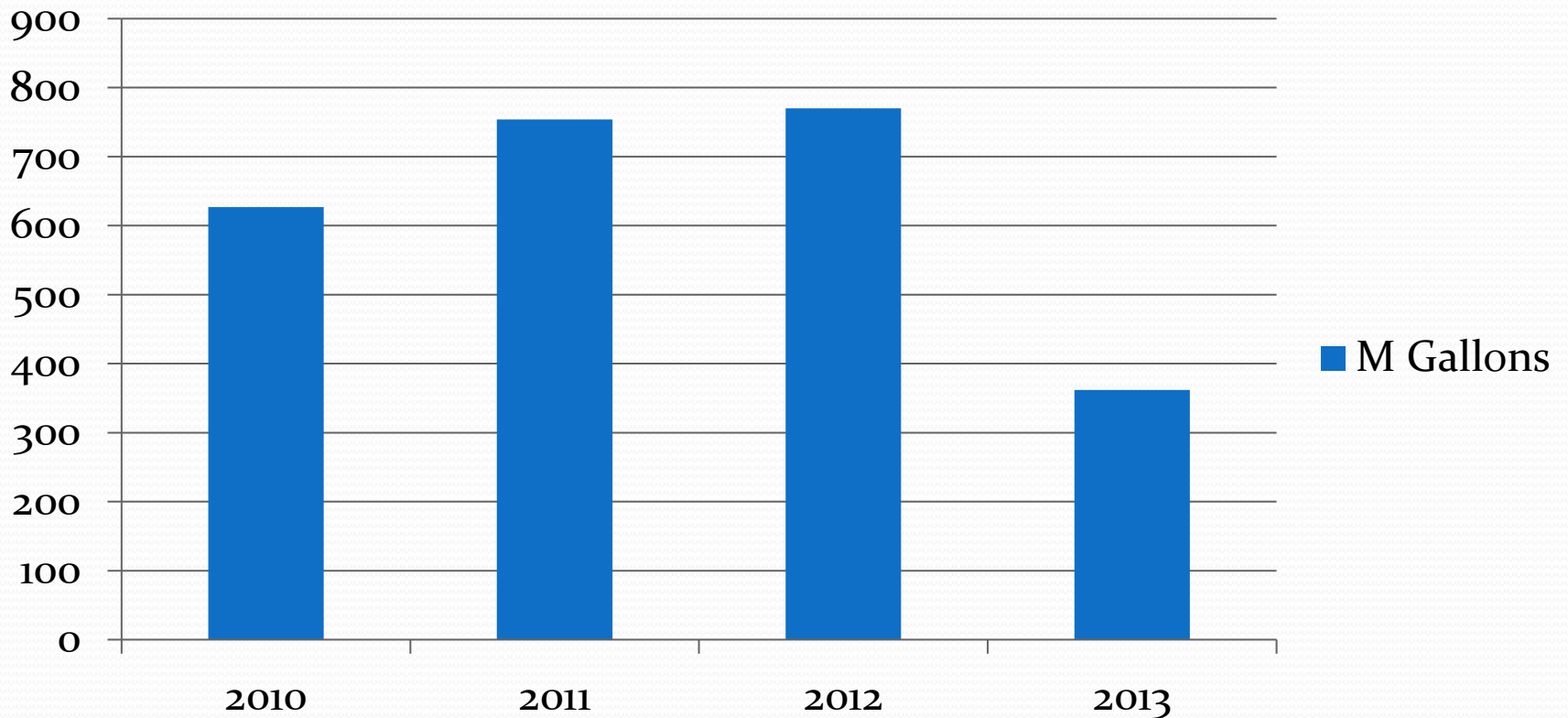


DD #1 Pumping Project

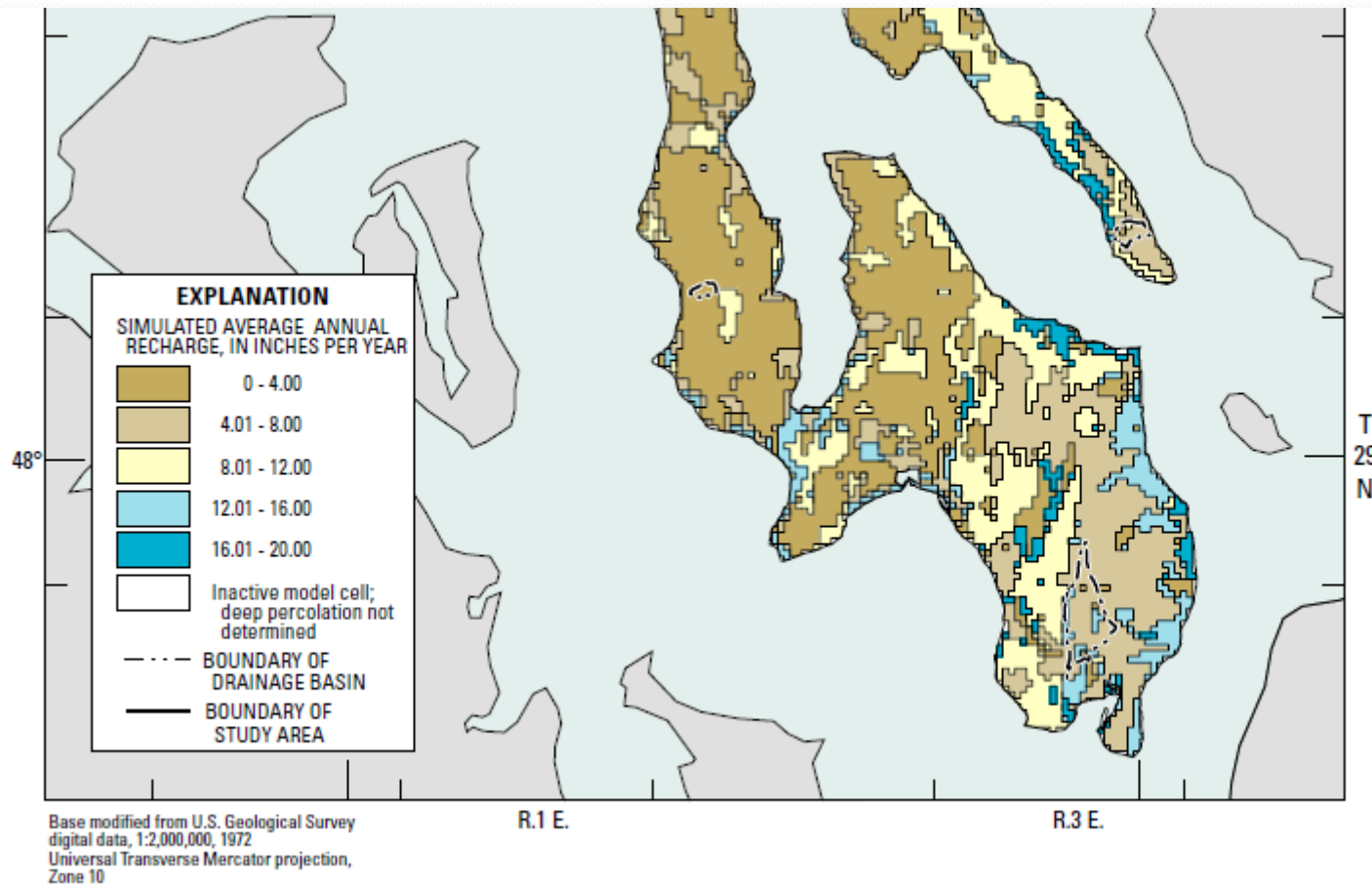


DD #1 Pumping Volumes

M Gallons



Groundwater Recharge



Rural

Rural Residential

Rural Center

Rural Forest

Rural Agriculture

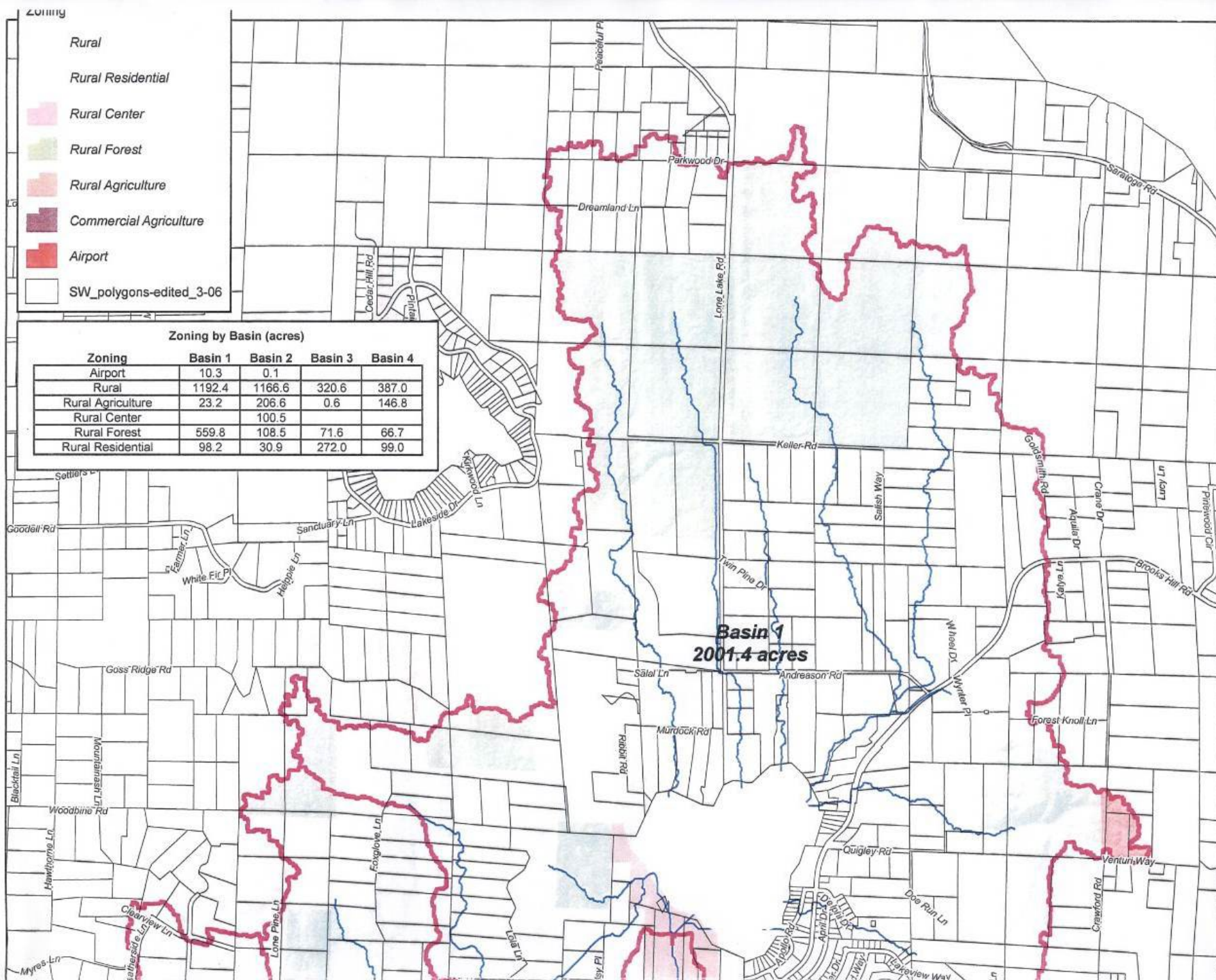
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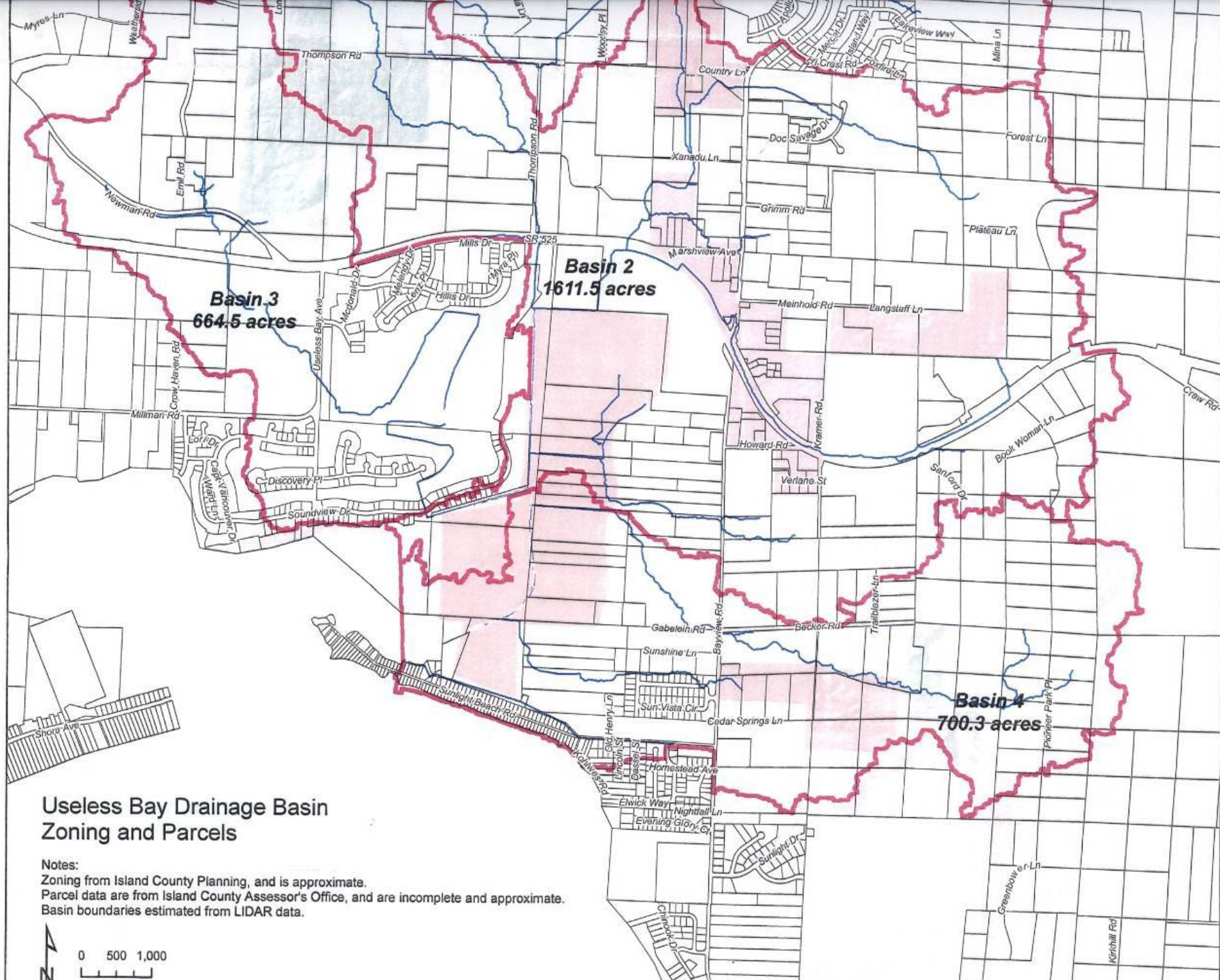
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Zoning by Basin (acres)

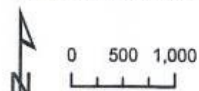
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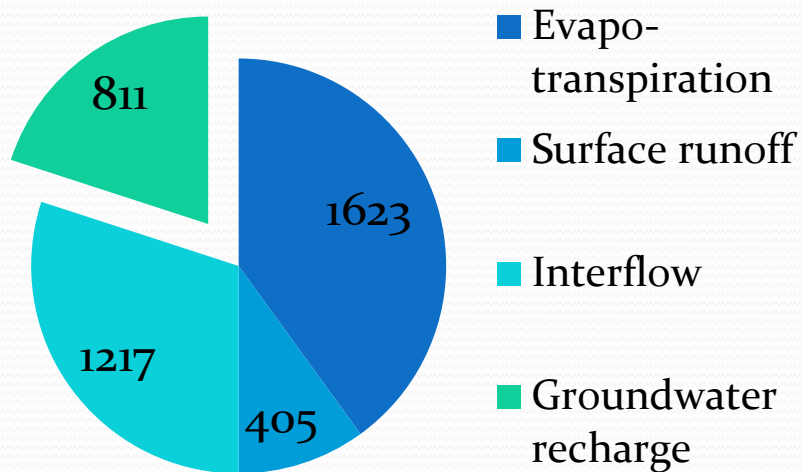
Useless Bay Drainage Basin Zoning and Parcels

Notes:
Zoning from Island County Planning, and is approximate.
Parcel data are from Island County Assessor's Office, and are incomplete and approximate.
Basin boundaries estimated from LIDAR data.

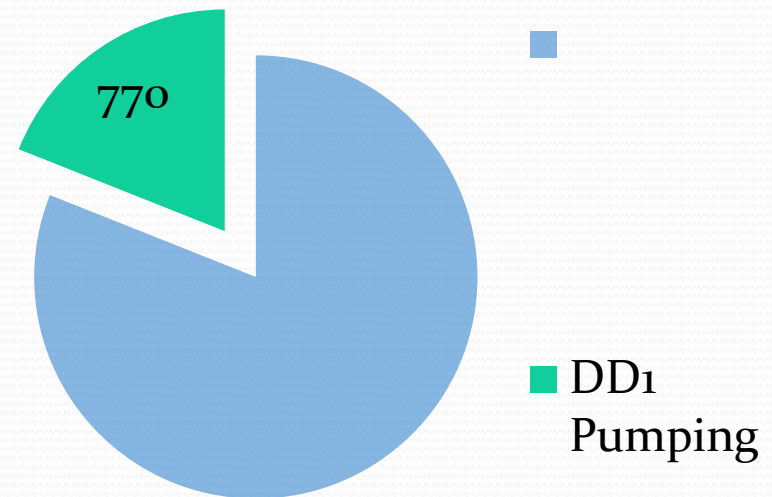


Rainwater Disposition

Disposition, M Gallons

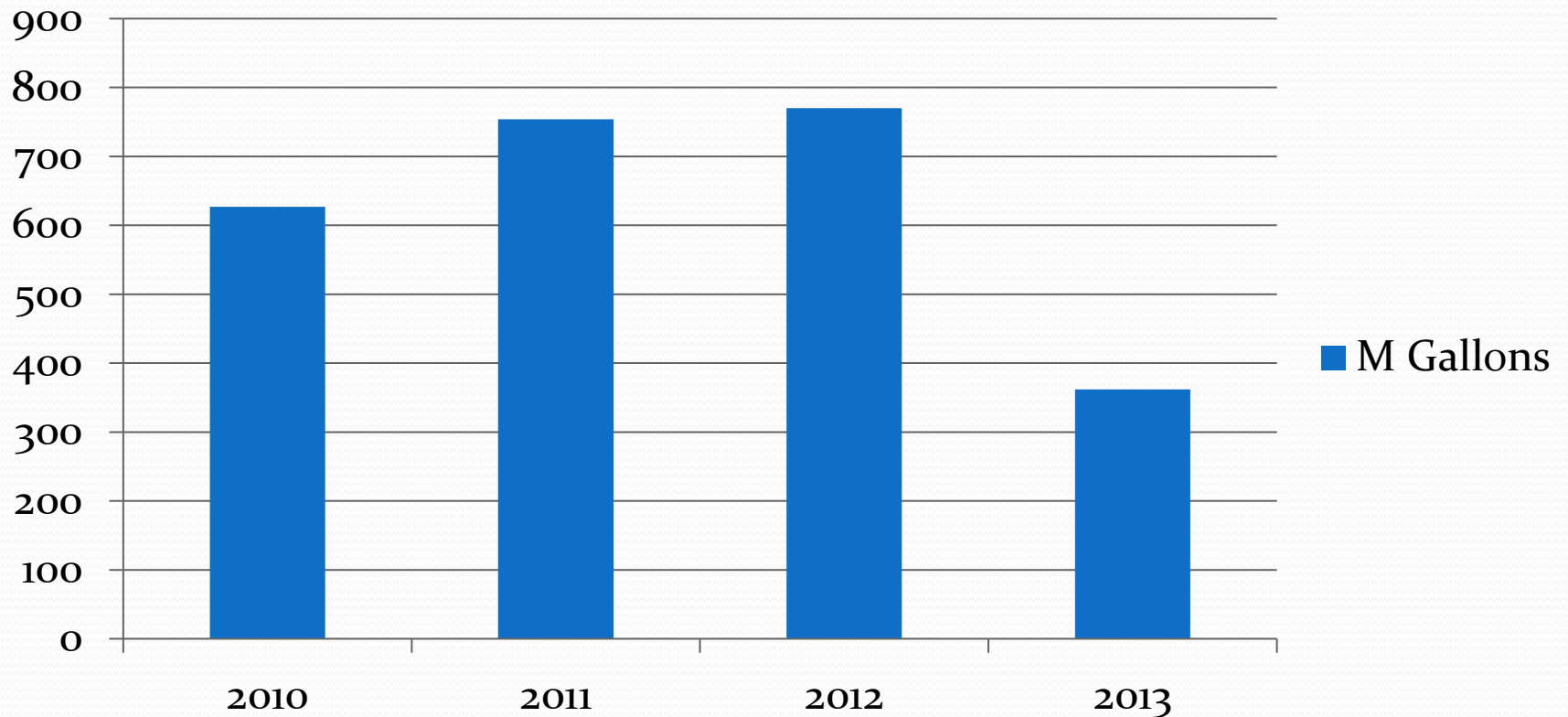


Pumping, M Gallons



DD #1 Pumping Volumes

M Gallons



Seawater Intrusion

- Not a current threat, but we cannot afford to be complacent
- Wetland dewatering by DD#1 has the potential to reduce wetland water level below sea level, opening the risk of seawater intrusion
- New operating plan maintains wetland ecology and reduces threat to wells
- Need for ongoing vigilance
- DD #1 has been copied on WHP document
- Cannot rule out the need for a new well in the future

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Wellhead Protection Program

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Results

- The property came back on the market at a reduced price
- The board of the water system decided to propose purchase of the property
- The members of the HOA approved the board's proposal

Observations

- Preparation of a Wellhead Protection Program is a significant burden for a small water system
- The Wellhead Protection Program is an essential tool in identifying current and potential threats
- We are looking forward to continuing support from regulatory agencies at local, State and County levels

Wellhead Protection

John Lovie

Sun Vista/Sunlight Beach HOA

Presented to Island County WRAC