Garden Home Historical Society:

Mapping the Historic Oregon Electric Railway and Current Built State of the Fanno Floodplain Using LiDAR and Aerial Imagery

Erin Woolbright
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Portland Community College

Introduction:

Garden Home is a small community situated in the north-easternmost corner of Washington county and partially crosses over into Multnomah county. Established in the late 19th century, Garden Home became a well-known stop along the Oregon Electric Railway. In Garden Home, the railway split into two lines: one proceeding on to Portland and the other traveling to Forest Grove.

In 1920, the Oregon Electric Railway (OER) as a widely used passenger line was abandoned, however ran as freight line until 1994. Much of the rail lines used by the OER were bought and rep-purposed by BN (now BNSF) and Union Pacific. A portion of the track from Tigard to Quinaby, previously owned by BNSF, was donated to the State of Oregon which in turn leases it to Portland & Western Railroad and is still in operation. The branch of the OER that ran from Hillsboro to Beaverton was repaired and repurposed by TriMet and is now a part of the MAX blue line route.

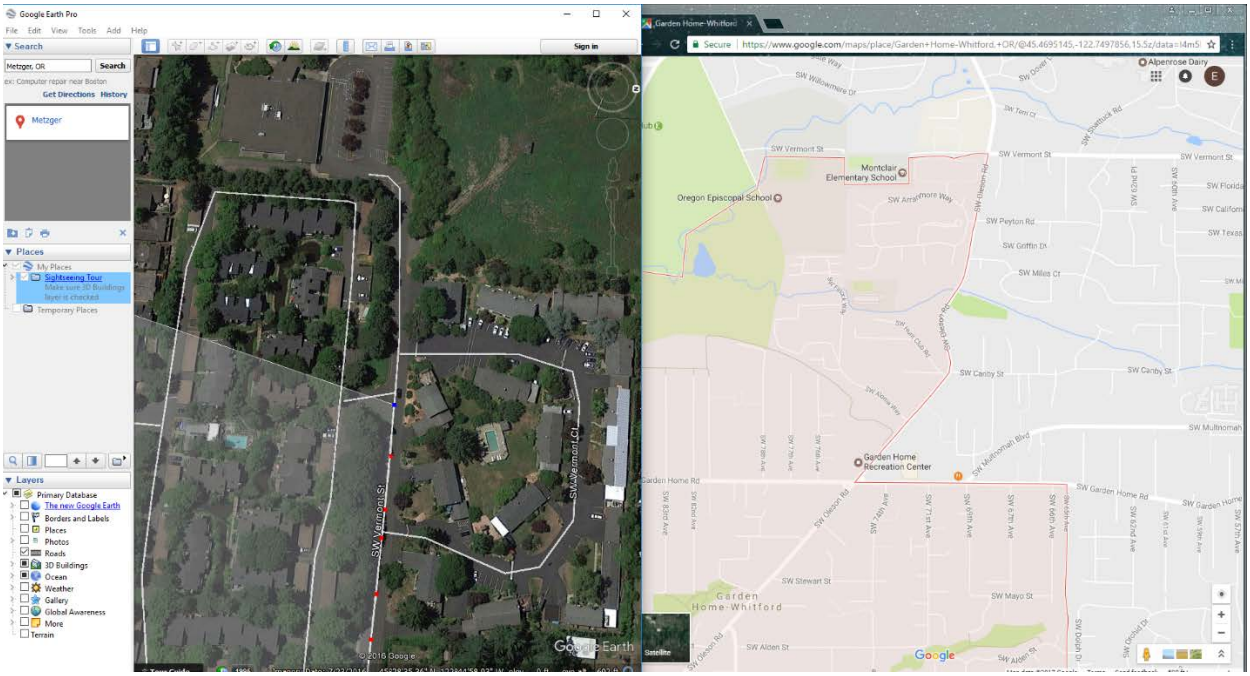
There are still large portions and branches of the OER that remain abandoned and forgotten. The history of Garden Home and the OER are strongly intertwined, which leads to the primary goal of this project: to find out where the route of the OER used to run through Garden Home. The secondary goals were to analyze the floodplains of Fanno and Ash creeks to determine their current built state and to create a geologic map of Garden Home. For these goals, I used both aerial and LiDAR imagery.

Methods:

To achieve these goals, the first thing that I did was gather data. I first downloaded a 10M DEM (Digital Elevation Model) provided by the Oregon Geospatial Enterprise Office (GEO) which coordinates with government agencies to develop and manage geographic information. GEO also hosts the Oregon Geospatial Data Clearinghouse. While the DEM I obtained from GEO is good quality, the resolution was not high enough to really see where the OER possibly ran. It was recommended to me to look at the

website of the Oregon Department of Geology and Mineral Industries (DOGAMI) to find a higher resolution DEM. I was able to download a 1M DEM from DOGAMI that was produced using LiDAR imagery. DOGAMI categorized their data by 7.5-minute USGS quadrangle. Due to Garden Home's location, I had to download both the Beaverton and Lake Oswego quadrangles. Each quad was just over 5 gigabytes in size, compressed.

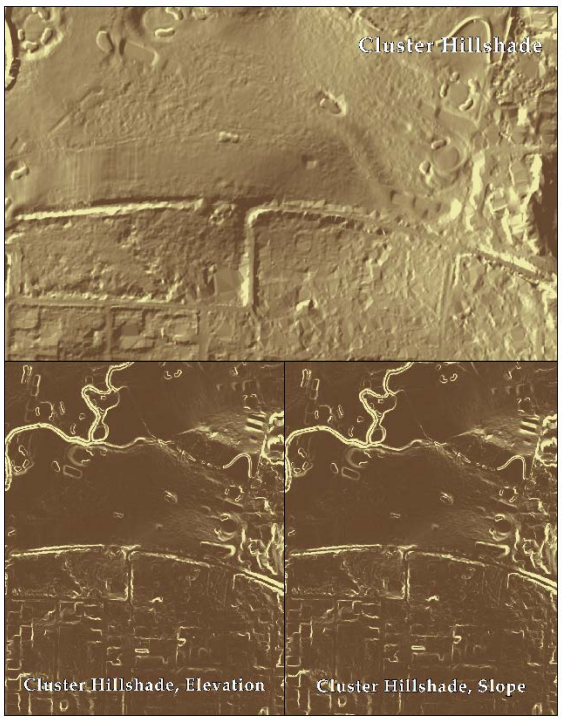
Once I had the quads, I joined them together using the *Mosaic to New Raster* function to combine the two quads into a single raster. I did this so I would only have to analyze one raster as opposed to running the same processes on two. I mosaiced both the bare earth rasters and highest hi rasters together. Next, I used a combination of Google Earth and Google Maps to digitize the boundary of Garden Home.



I imported my newly created boundary into ArcMap so I could define the project area on the single raster that I previously generated. My intention was to use the Garden Home boundary to clip the raster so that I had a smaller, more concise area to work with. A large raster, especially the one that I

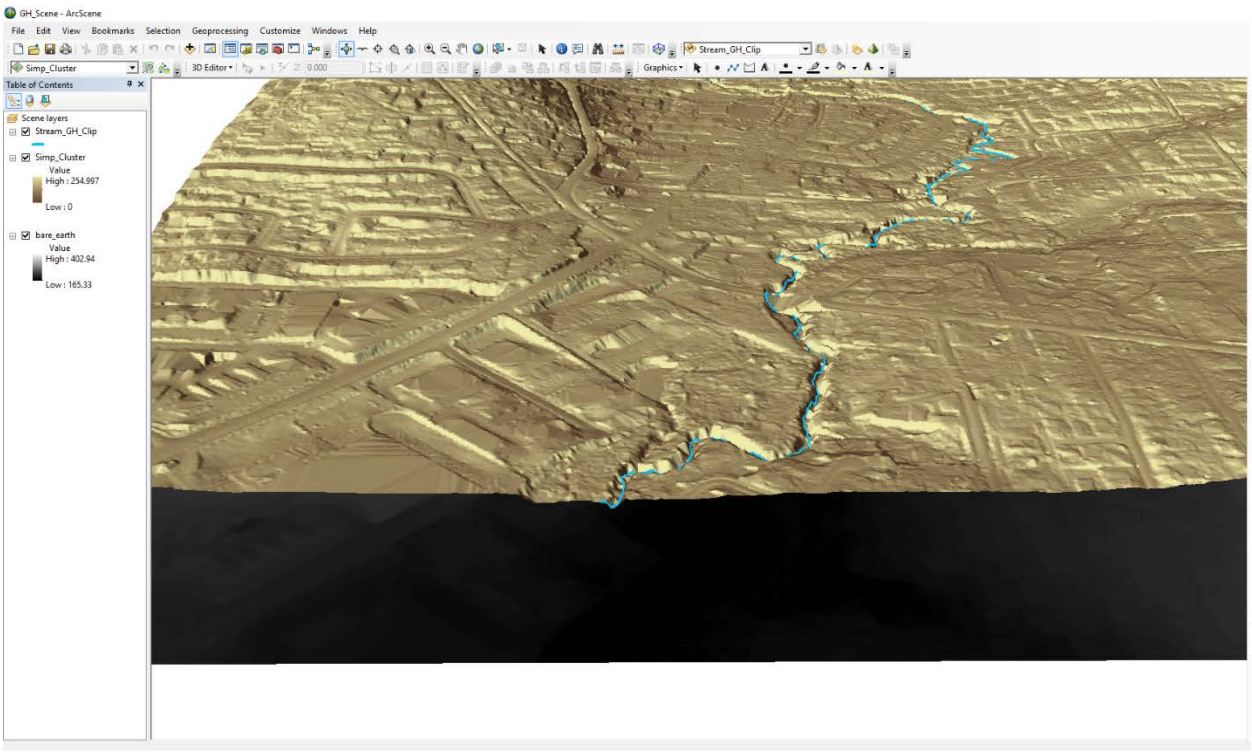
was working with, takes a long time to run geoprocesses on since each process would have to go through all data points contained within the raster. This means that each cell, which is 1 square meter, is a data point that any terrain process that I wanted to run would have to go through. A smaller raster would greatly cut processing time. Unfortunately, when I tried to clip the raster with the Garden Home boundary, I kept running into errors. Mainly an error referencing z-values. After reading through several posts on GeoNet, I tried converting the Garden Home boundary polygon into a feature class using the *Feature to Polygon* function. Using the Garden Home boundary feature class, I was able to clip the raster. I left the "Use Input Features for Clipping Geometry" and "Maintain Clipping Extent" boxes unchecked since I also wanted to preserve a portion of the surrounding area for reference.

Once I was able to clip the raster, I began running geoprocessing functions to see which would give me the best visibility of the land contours. After trying a standard, MDOW, slope, cluster, cluster elevation and cluster slope hillshades, I decided to use a cluster hillshade as it gave me an overall better visual of the land formations.

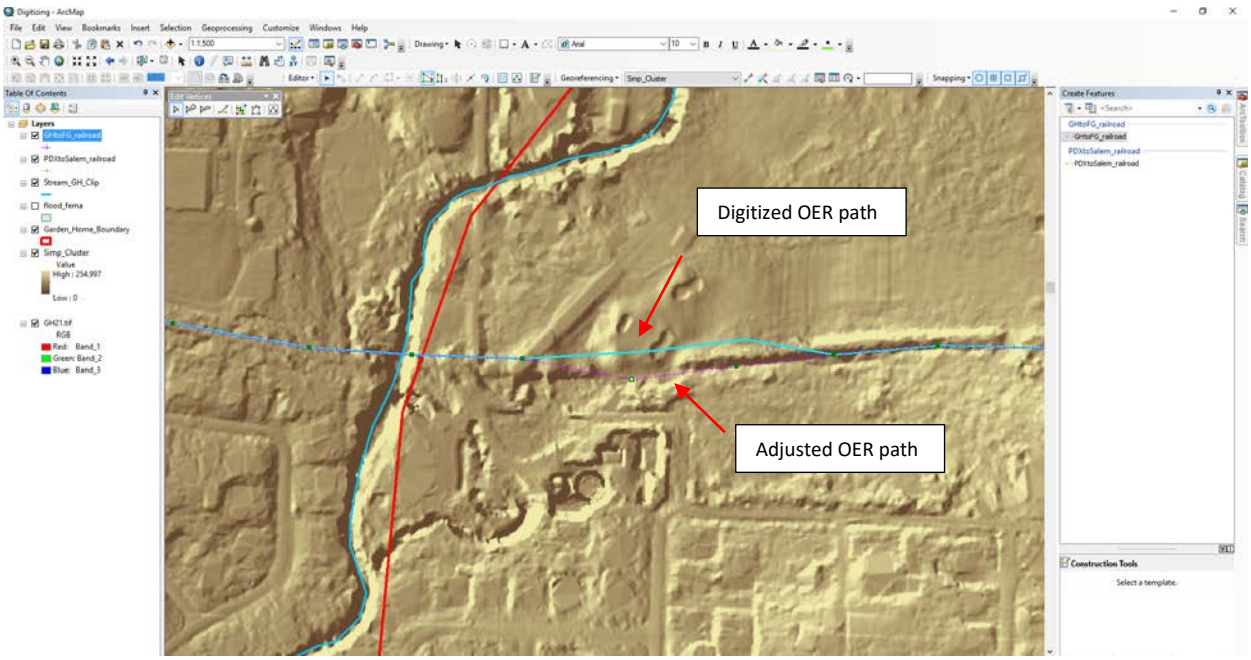


All three hillshades are using the light to dark brown color ramp, non-inverted, stretch type is standard deviation, n value of 2.

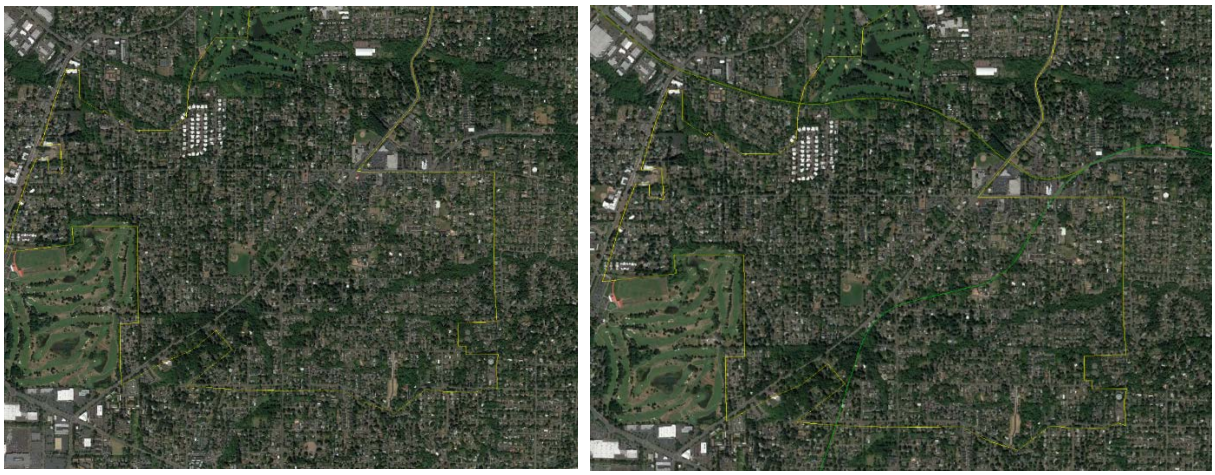
Now that I could clearly see the physical nuances of the area, I began adding the shapefiles involved with the project. I added the streams layer obtained from RLIS at the beinning of the quarter. Using the bare earth raster that I had just hillshaded, I could see that the stream layer wasn't quite aligned with the stream channel. I converted the stream layer to a .kmz file and imported it into Google Earth to see where the streams ran in up-to-date aerial imagery. From looking at Google Earth and the hillshaded bare earth layer, I could see that the two large creeks that ran through Garden Home, Fanno and Ash, were placed in the same general area of the channels. Since I could clearly see where the channels were on the hillshade layer, I set about adjusting the creeks into their proper locations. Once I moved the streams into the channels that I could see on the hillshade layer, I went into ArcScene and added the original bare earth raster, hillshade layer, and edited stream layer. I used the bare earth raster as the base heights for all three layers. I did this to see if I had accurately moved Fanno and Ash creeks.



One of the reasons why I moved the streams was not only for accuracy's sake, but also to eliminate the furrows in the ground that belonged to the creeks and their drainage channels so I could then evaluate the remaining deep "grooves" in the ground for a possible location of the OER. I was able to make an approximation of where it was from looking at the old photos of Garden Home that included the OER and matching approximate locations on the LiDAR imagery. This was confirmed when I was able to add shapefiles with the digitized OER generated by Spencer Kuroda using blueprints from the W.S. Barlow Co..

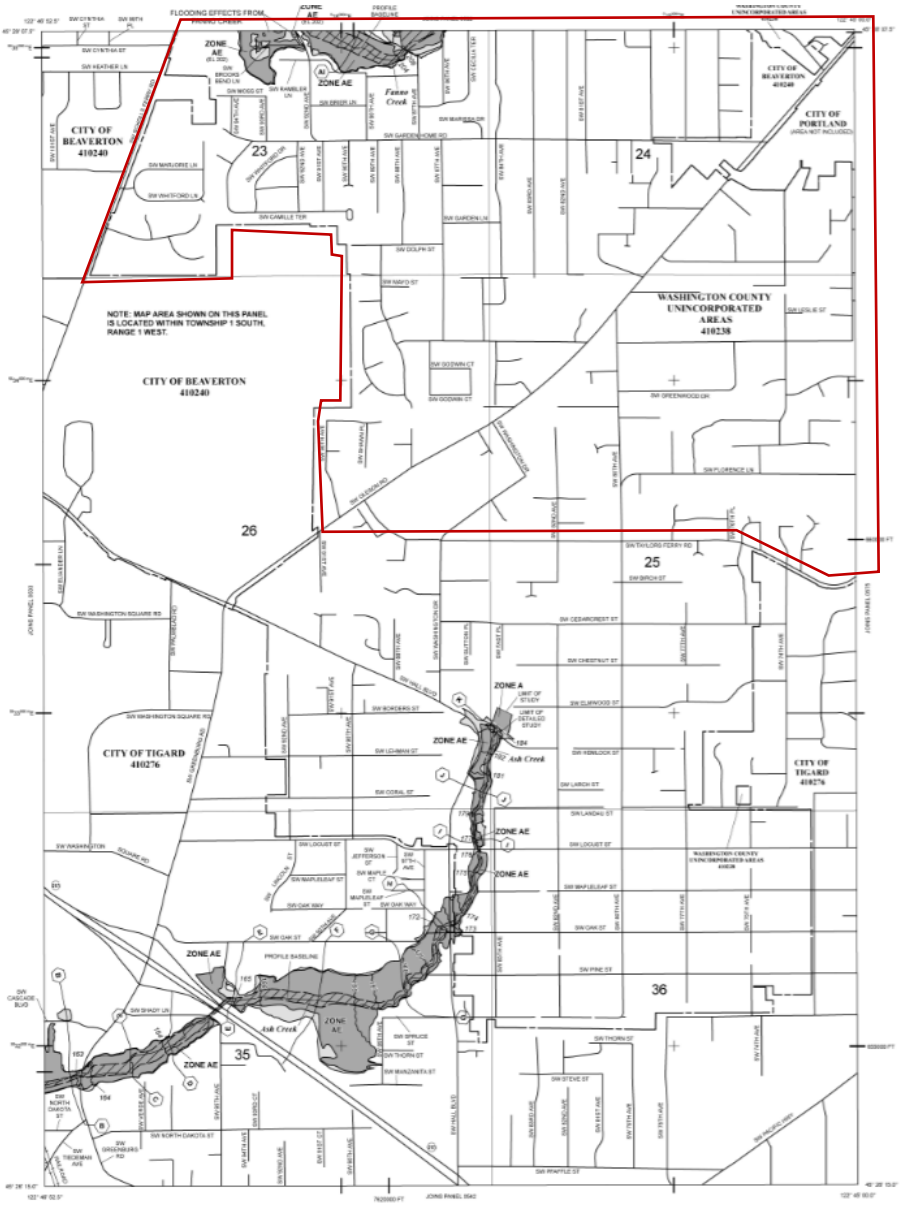


After adjusting the path of the OER, the Forest Grove branch can be seen to cut east to west across Garden Home largely following the tree line at the south end of the Portland Golf Club and then run parallel to SW Allen Blvd. Portions of the PDX to Salem branch, which runs south southwest through Garden Home, bisects straight through a few blocks of housing but it too primarily follows a visible tree line through town.



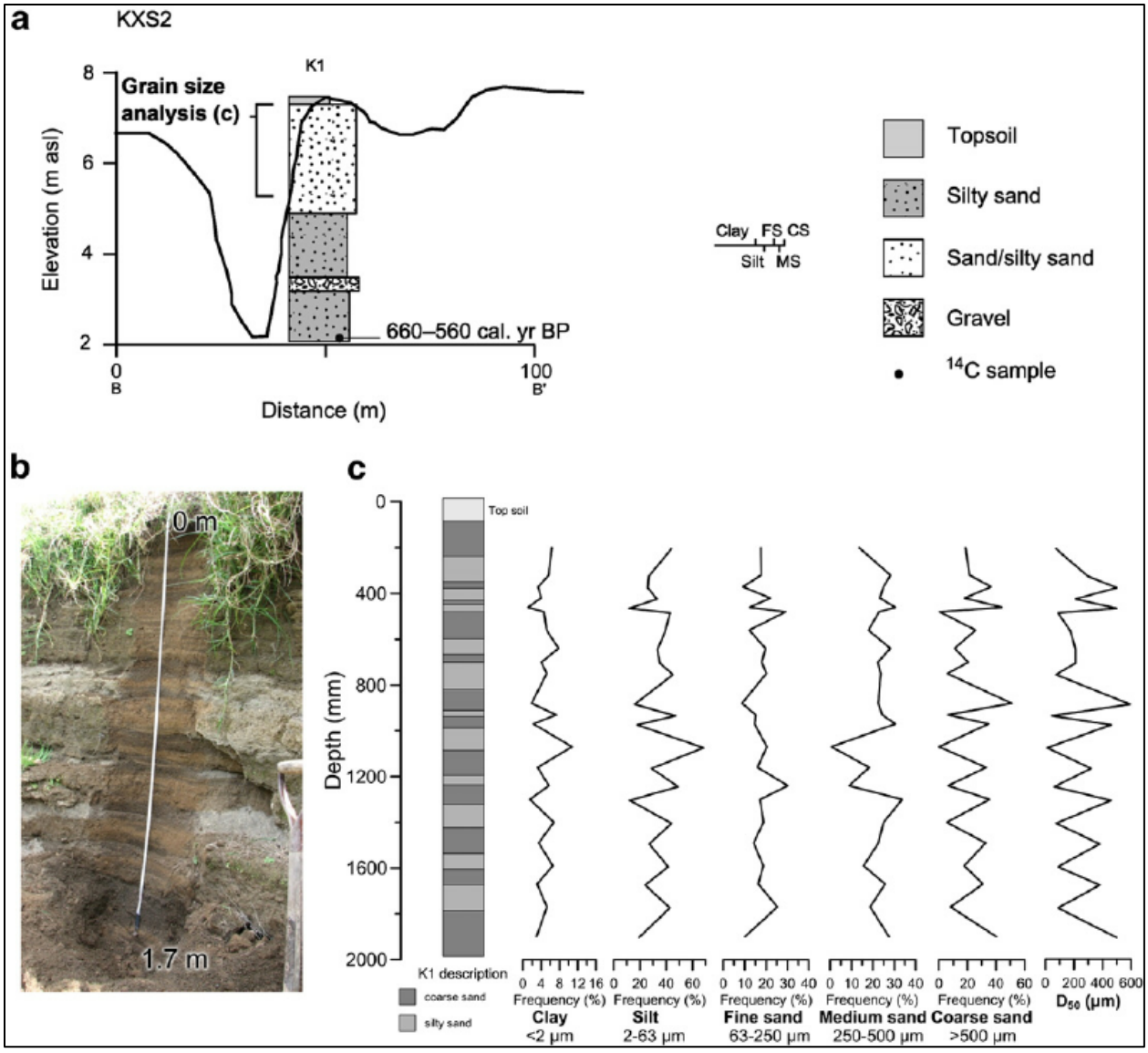
Left: Garden Home without OER routes. Right: Garden home with OER routes

Once I finished working with the OER, I added the floodplain shapefile obtained from RLIS and created by FEMA. Out of the two major creeks in Garden Home, Fanno and Ash, only information regarding Fanno Creek was available. I found a paper map that was current as of 2015 from FEMA with portions of Ash Creek's floodplain mapped, however it didn't extend all the way up to Garden Home. I spent several hours looking for any information regarding Ash Creek. I read archived community news releases, articles from the county and state agencies and there was no mention of any major flooding of Ash Creek. Storm call data procured from Clean Water Services only shows an average of 5 calls a year in the Ash Creek area of Garden Home, however those calls are usually regarding a blocked storm drain. On the other hand, there is plenty of information regarding Fanno Creek, which seems to flood significantly every year.



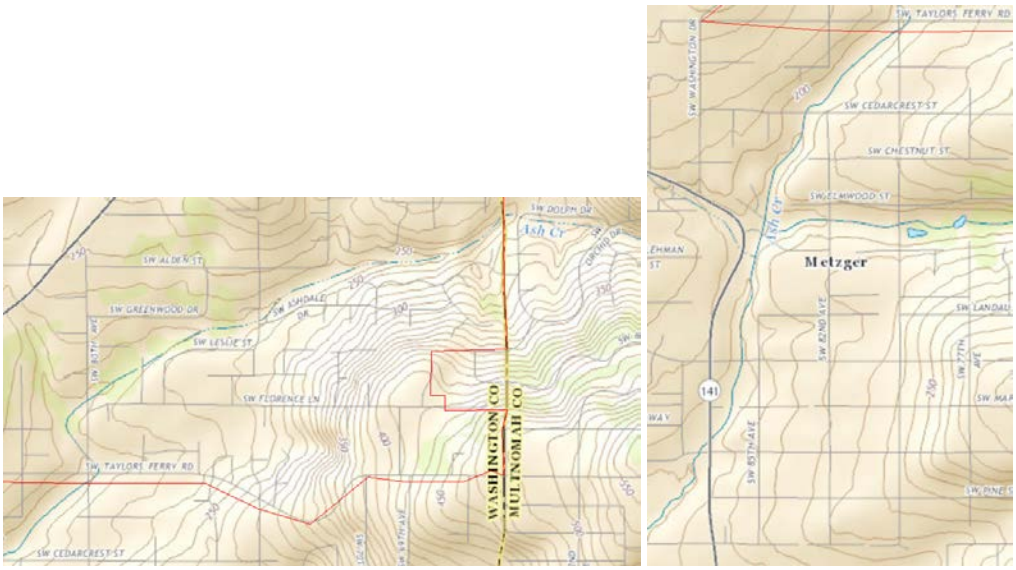
FEMA map with established floodplain surrounding Ash Creek with the portion of Garden Home visible enclosed by the red box.

Calculation and determination of a floodplain involves extensive modelling and field sampling. For field sampling, a geologist would go out and take core samples of the ground surrounding a water body, such as Ash Creek, at varying distance intervals. From there, an analysis would be done on each core sample. A single sample represents days of analysis depending on the complexity. I have experience performing this type of analysis when studying floodplain creep of Reecer Creek in Ellensburg, WA and can attest to the considerable amount of time it takes to run the analysis.



An example of a single floodplain core sample, courtesy of researchgate.net. Analysis performed by researchers from Massey University in New Zealand and the University of Lincoln in the UK.

Land topography also plays a major role in floodplain determination and the topography surrounding Ash Creek in Garden Home just doesn't indicate a high flood potential. That's not to say flooding attributed to Ash Creek doesn't happen, it just doesn't happen with the same frequency or magnitude of Fanno Creek.



Left: Topography surrounding the section of Ash Creek that runs through Garden Home. Right: Section of Ash Creek the runs up to Garden Home and has an established floodplain determined by FEMA. The red lines represent the boundary of Garden Home.

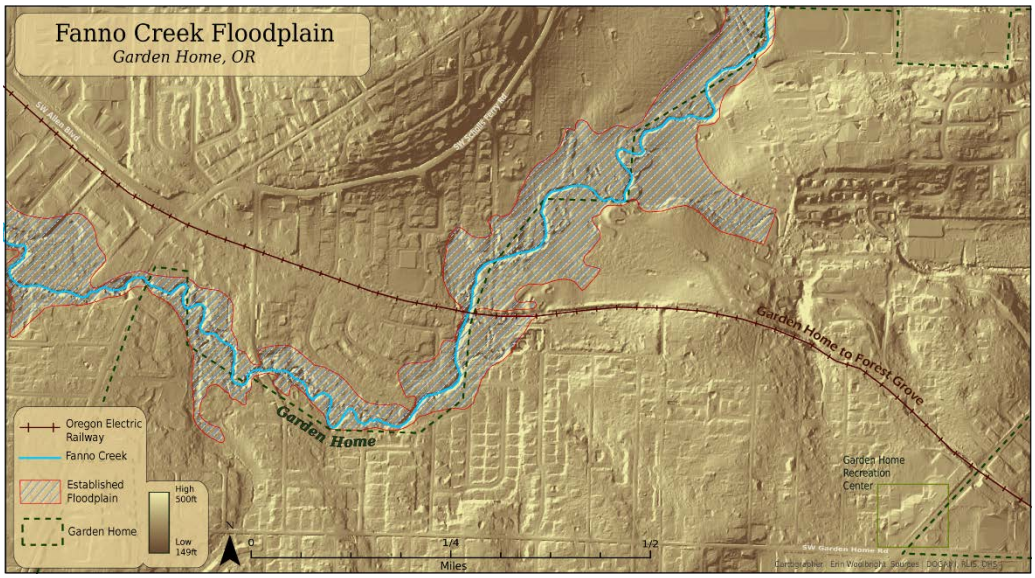
The final goal of making a geologic map was the easiest portion of this project. To do this, I downloaded a geologic map of Oregon from the USGS and used an aerial photo that I georeferenced and converted to an image earlier in the project to clip the geologic map to Garden Home and the surrounding area. I added the Garden Home boundary shapefile and a circular symbol that represents the location of the Garden Home Recreation Center as a point of reference. From looking at the geology of Garden Home, I could see how the geology of the area could have possibly been an influence on the decision to construct the OER through Garden Home. Much of Garden Home is set upon catastrophic flood deposits, fine-grained type. This type of unit allows for easier construction as opposed to coarse-grained type or the various basalt-bedrock formations that surround the area.

Results:

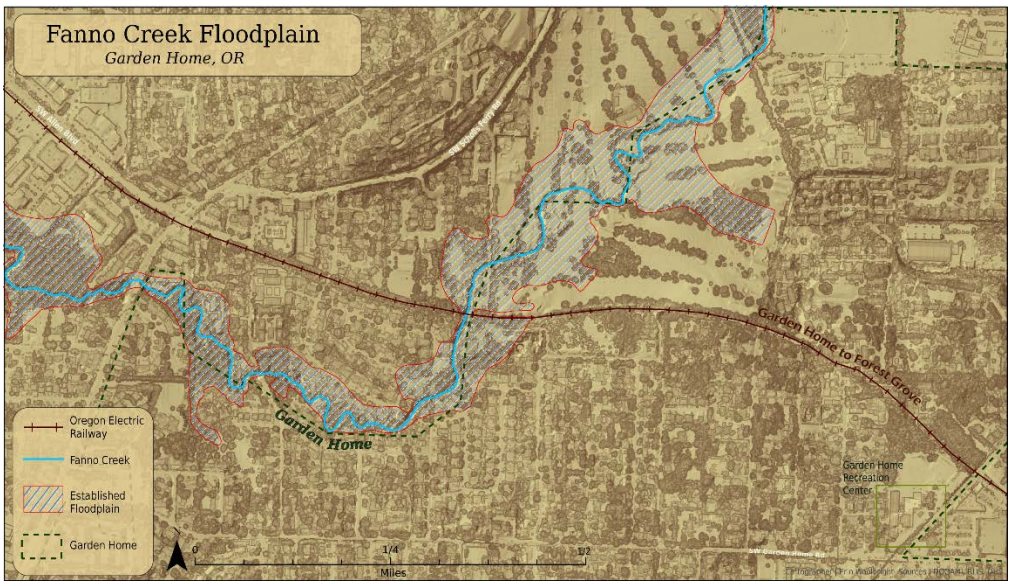
Using LiDAR and aerial imagery I was able to gain a rough idea as to where the OER used to run through Garden Home by eliminating current features such as creeks, culvert, and drainages, streets, roads and trails and looking at historic phots and route maps. Once I had the digitized OER route

shapefiles, my interpretation was confirmed. Unfortunately, I was unable to obtain data or virtually any information regarding an Ash Creek floodplain as it ran through Garden Home, however I was able to map out where the current Fanno Creek floodplain is and show what homes, businesses and infrastructure are currently affected. I was also able to create a geologic map specific to Garden Home using data from the USGS.

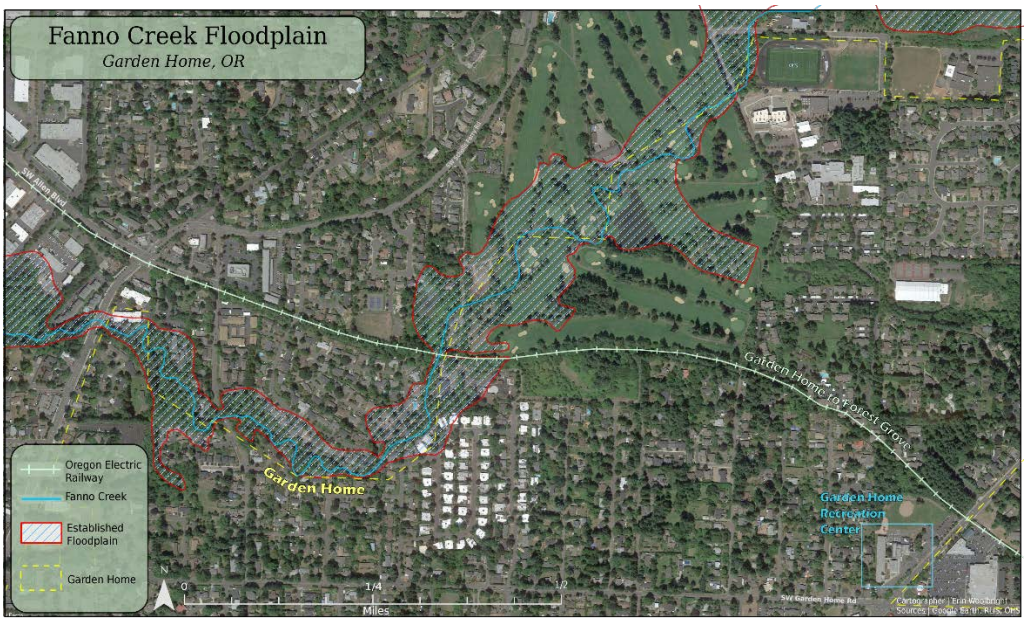
Maps:

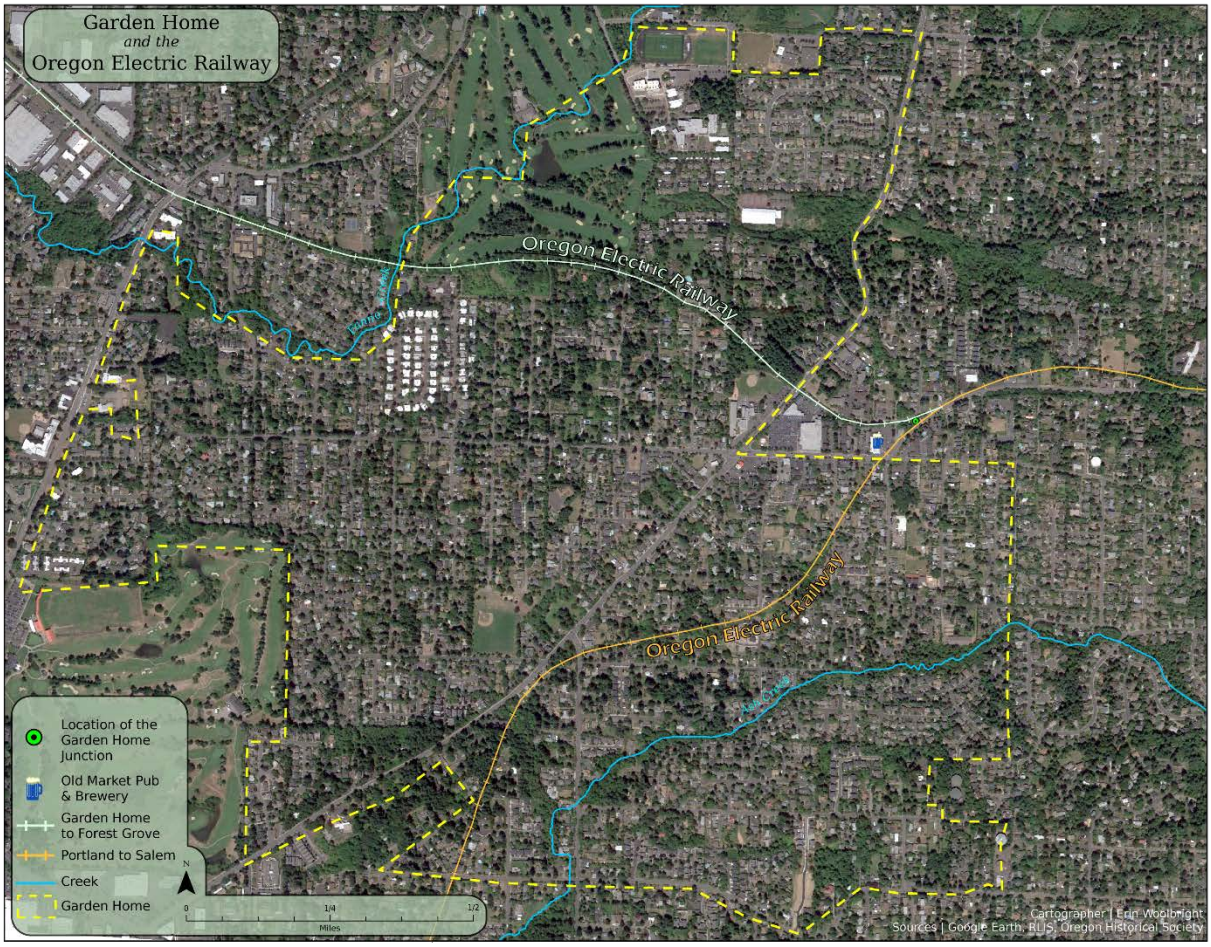


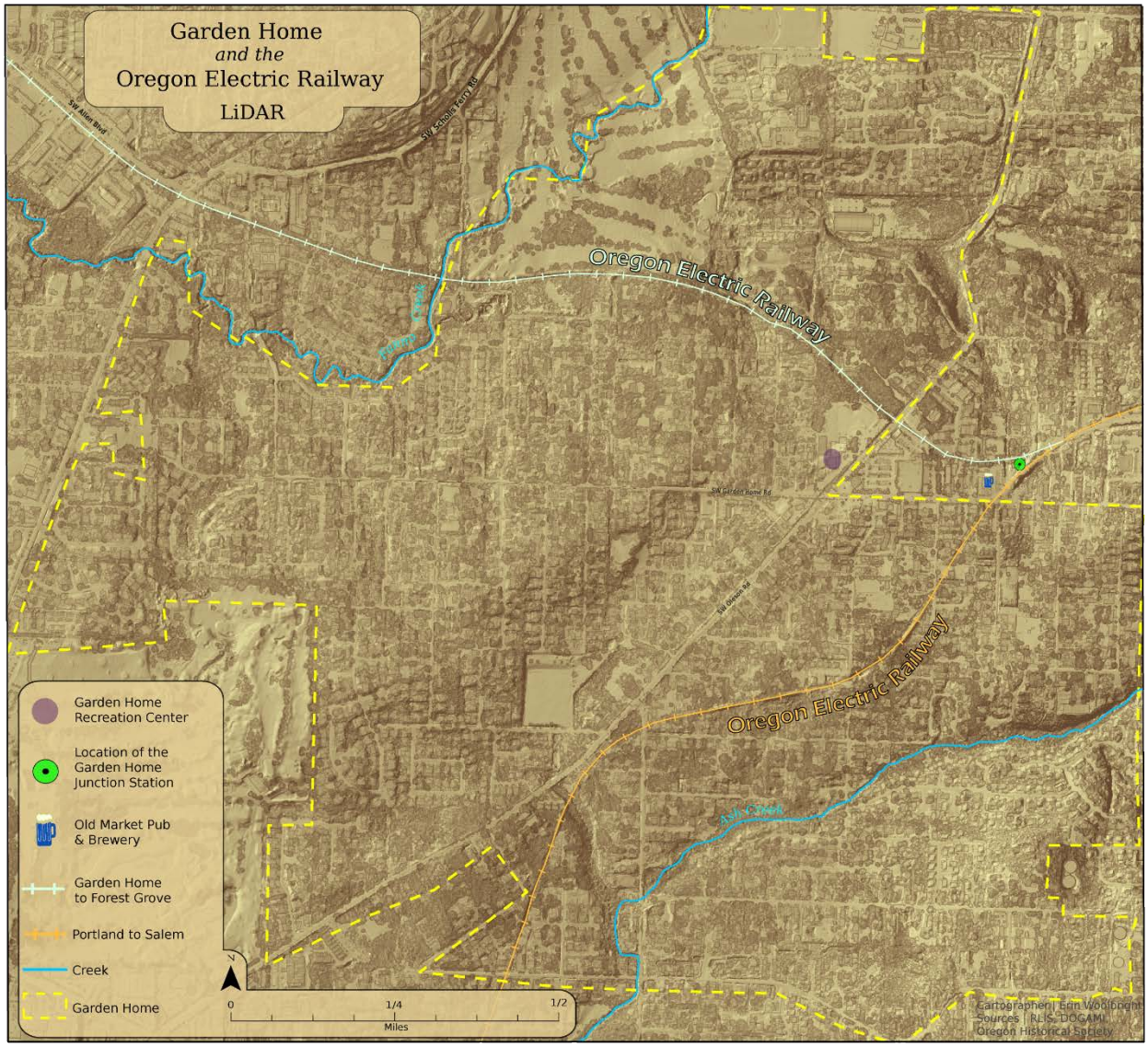
Garden Home, Fanno Creek floodplain set against bare earth cluster hillshade



Garden Home, Fanno Creek floodplain against highest hit and bare earth combined




Garden Home
and the
Oregon Electric Railway
Oregon Electric Railway
Oregon Electric Railway
Fanno Creek
Ash Creek
Location of the Garden Home Junction
Old Market Pub & Brewery
Garden Home to Forest Grove
Portland to Salem
Creek
Garden Home
N
0
1/4
1/2
Miles
Cartographer | Erin Woolbright
Sources | Google Earth, BLM, Oregon Historical Society


Garden Home
and the
Oregon Electric Railway
LiDAR
SW Allen Blvd
SW Scholls Ferry Rd
Oregon Electric Railway
Fanno Creek
SW Garden Home Rd
SW Oleson Rd
Oregon Electric Railway
Ash Creek
Garden Home
Recreation Center
Location of the
Garden Home
Junction Station
Old Market Pub
& Brewery
Garden Home
to Forest Grove
Portland to Salem
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Sources | RLIS, DOGAMI,
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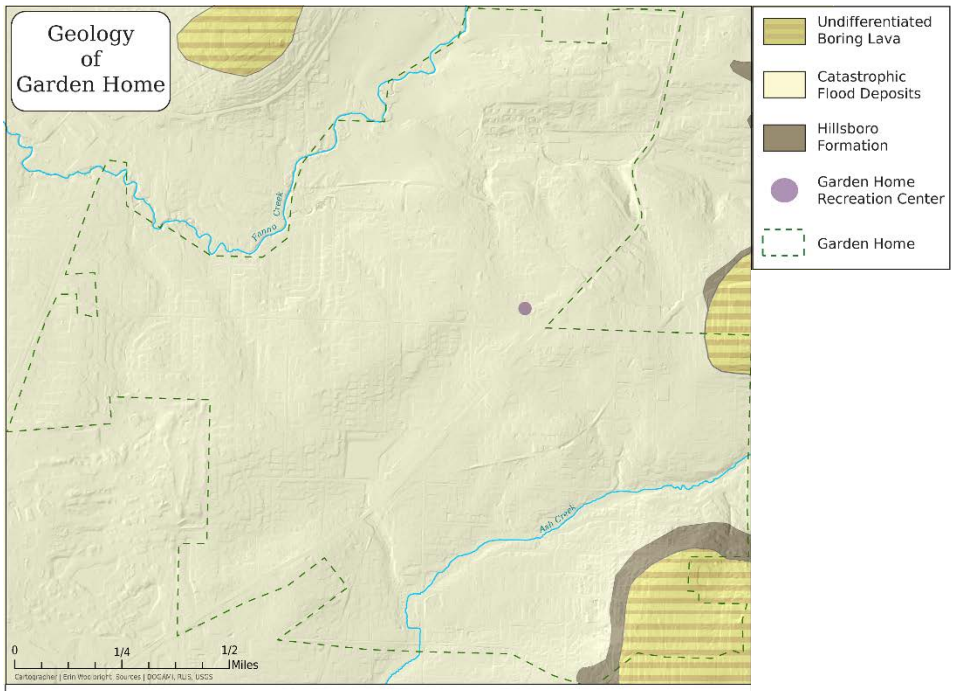

Undifferentiated Boring Lava:
Basalt flows that have not been separated into individual units based on age or chemistry. These flows are produced by volcanic vents that are located all over the Portland Metropolitan area, including the suburbs. This is only one of the few places in the continental US that have extinct volcanoes within the city limits.

Catastrophic Flood Deposits:
Boulder to pebble-sized gravel, sandy gravel, sand and silt containing high percentages of Columbia River basalt that was deposited during high-energy flooding events, such as the Missoula Flood that was the result of the failure of a glacial ice dam which occurred approximately 15,000 to 13,000 years ago.

Hillsboro Formation:
Claystone, siltstone and sandstone depositions over the Columbia River Basalt west of the crest of the Tualatin Mountains.

Data Source	Description
DOGAMI	Beaverton and Lake Oswego LiDAR quadrangles
USGS	Geologic map of Oregon
FEMA	Current established extent of Ash Creek floodplain
Google Earth	High resolution aerial images
Garden Home Historical Society	Historic aerial imagery
RLIS	Stream and floodplain layers
Oregon Historical Society	W.S. Barlow Co. blueprints Spencer Kuroda used to digitize OER routes
Spenser Kuroda	Digitized railway routes
Clean Water Services	Storm call data