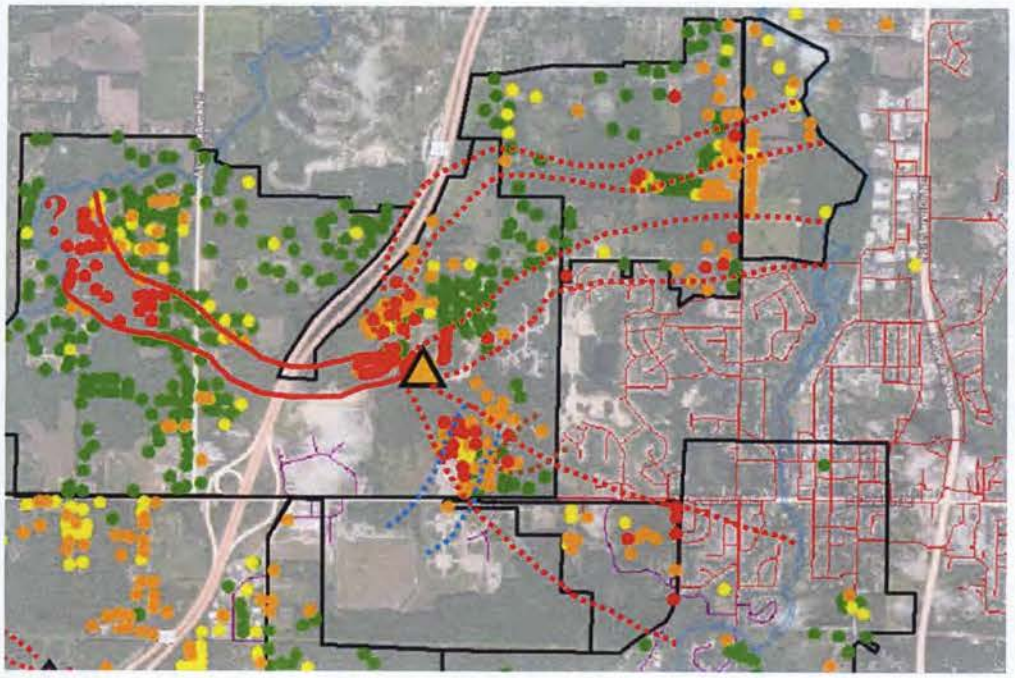
# Geologic Review

## DEQ-RRD Grand Rapids District

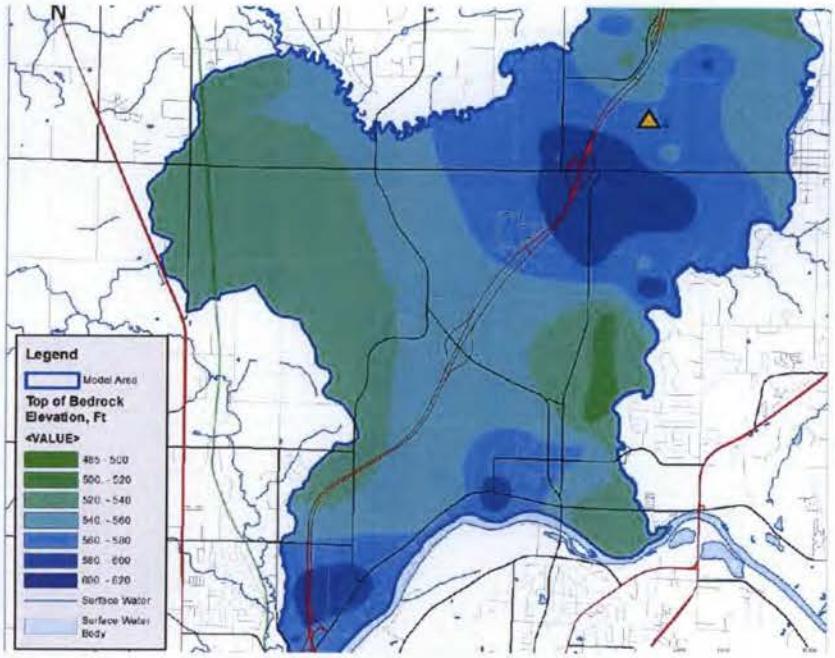
### Perfluoroalkyl and Polyfluoroalkyl Substances Plume Evaluation of the Primary Wolven-Jewell Plume - 12-2018

This evaluation of perfluoroalkyl and polyfluoroalkyl substances (PFAS) impact encompasses this area west of the Wellington Ridge disposal area to the Rogue River. This review includes the primary Wolven-Jewell plume emanating from the Wellington Ridge disposal area (see figure below and attached figures) and uses residential well data collected by Wolverine World Wide (WWW). The DEQ analyzed the drinking water well sample results, screen elevation and surrounding geology to develop this geologic model.



PFAS groundwater plumes emanating from the Wolven-Jewell source area in Wellington Ridge. The source area is illustrated by the orange triangle; the principle Wolven-Jewell PFAS groundwater plume is illustrated by the solid lines and the secondary PFAS groundwater plumes are illustrated by the dashed lines.

This area is a kettle and kame glacial depositional environment that overlies bedrock of higher elevation with a bedrock high immediately southwest of the modeled area (see GZA figure below).




Bedrock elevations from GZA document dated 2-8-18. Orange triangle marks the disposal site in the Wellington Ridge Neighborhood.

The primary plume migrates west from the Wellington Ridge neighborhood (the neighborhood is on the right hand side of the attached figures) migrating along an un-named creek. This creek mirrors a paleo-fluvial feature or old stream valley that can easily be seen in LIDAR (Light Detection and Ranging) of the area (see the figure below) with this paleo-fluvial feature controlling the plume location. The paleo fluvial feature's deposition and location is likely in part controlled by the bedrock high that is immediately south of the drainage feature and illustrated on the bedrock map above and provided by GZA. The plume emanating from the west side of the Wellington Ridge neighborhood is at elevations of approximately 725 to 680 feet per current data (total depth of impact is currently unknown).

The plume follows the paleo-fluvial feature to the west, narrowing as the plume/ paleo-fluvial feature cuts through the highlands in the vicinity where the stream/paleo-fluvial feature is crossed by Algoma Avenue. The narrowing of the plume is illustrated by the drinking water results at 8824 Algoma Avenue (non-detect) which sits immediately adjacent to the paleo-fluvial feature to the west, but just out of the feature and has a well screened at the same depth as the plume (see attached Figures 1 and 3). West of Algoma Avenue there is a widening of the plume as the plume encounters the alluvial fans of the paleo-fluvial feature and nearing the Rogue River.

In the vicinity of Algoma Avenue, there are a number of residential drinking water wells that are non-detect giving the plume a bisected appearance. The plume is continuous, and this illusion is

due to the drinking water wells on Clearwater Court being screened at elevations below the plume and the drinking water wells on Winding Ridge falling outside the paleo-fluvial feature. The plume then curves to the north where the Rogue River curves from a flow to the north to a flow to the east in the area of the 11 Mile Road and Jewell Avenue intersection. Additionally, based on the residential well data near the river, the plume may be deepening to at least an elevation of 620 feet, however, there is a lack of remedial investigation data throughout the plume to understand if this depth of impact occurs only at the Rogue River. Based on the lack of data immediately at the river on the west/north side of the river and the potential deepening of the plume it is currently unclear if the plume migrates under the Rogue River.


LIDAR image from Google Earth of the area from the source area in the Wellington Ridge neighborhood west to the Rogue River illustrating the relevant geologic features impacting plume dynamics.

Installation of a number of additional monitor well locations is necessary to fully understand the primary Wolven-Jewell PFAS plume both latterly, at depth and across the river to the west and north.

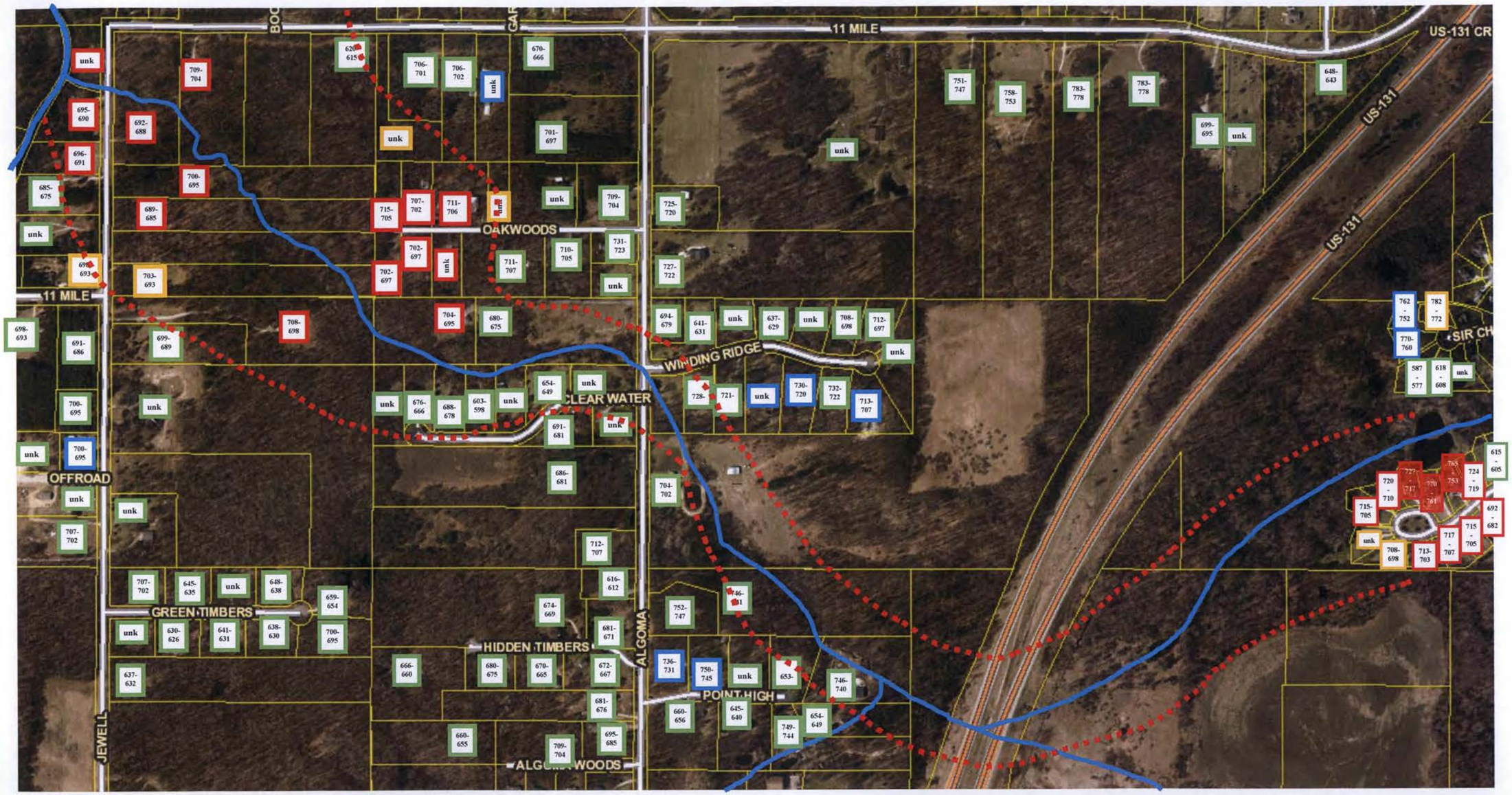
Attachments:

- Figure 1 - PFOS/PFOA – Analysis of Drinking Water Well Results of the Primary Wolven-Jewell Plume
- Figure 2 – PFOS/PFOA – Analysis of Drinking Water Well Results of the Primary Wolven-Jewell Plume

- Figure 3 - Total PFAS – Analysis of Drinking Water Well Results of the Primary Wolven-Jewell Plume
- Figure 4 – Total PFAS – Analysis of Drinking Water Well Results of the Primary Wolven-Jewell Plume
- Figure 5 – Total PFAS – Analysis of Drinking Water Well Results of the Primary Wolven-Jewell Plume Including Drinking Water Wells West and North of the Rogue River

Geologist Signature: _____ Date: 2-15-2019

Mark Worrall, District Geologist




North

**Figure 1—PFOS/PFOA**

**Analysis of Drinking Water Well Results of the Primary Wolven-Jewell Plume**

**Algoma Township MI**

709-704 **Below Method Detection Level**

736-731 **PFOS/PFOA: <20ppt**

703-693 **PFOS/PFOA: 20 to 70ppt**

704-695 **PFOS/PFOA: >70ppt**

704-695 **PFOS/PFOA: >1,000ppt**

**Stream or River**

663-658 **Elevation of Well Screen** (Top of Screen-Bottom of Screen)

unk **Well Screen Information Unknown**

**Note - Well depths have been placed over where the residences are.**

**Note - Results are the initial sample results for the drinking water well**

**Updated by the MDEQ-RRD-GR 11/27/2018**

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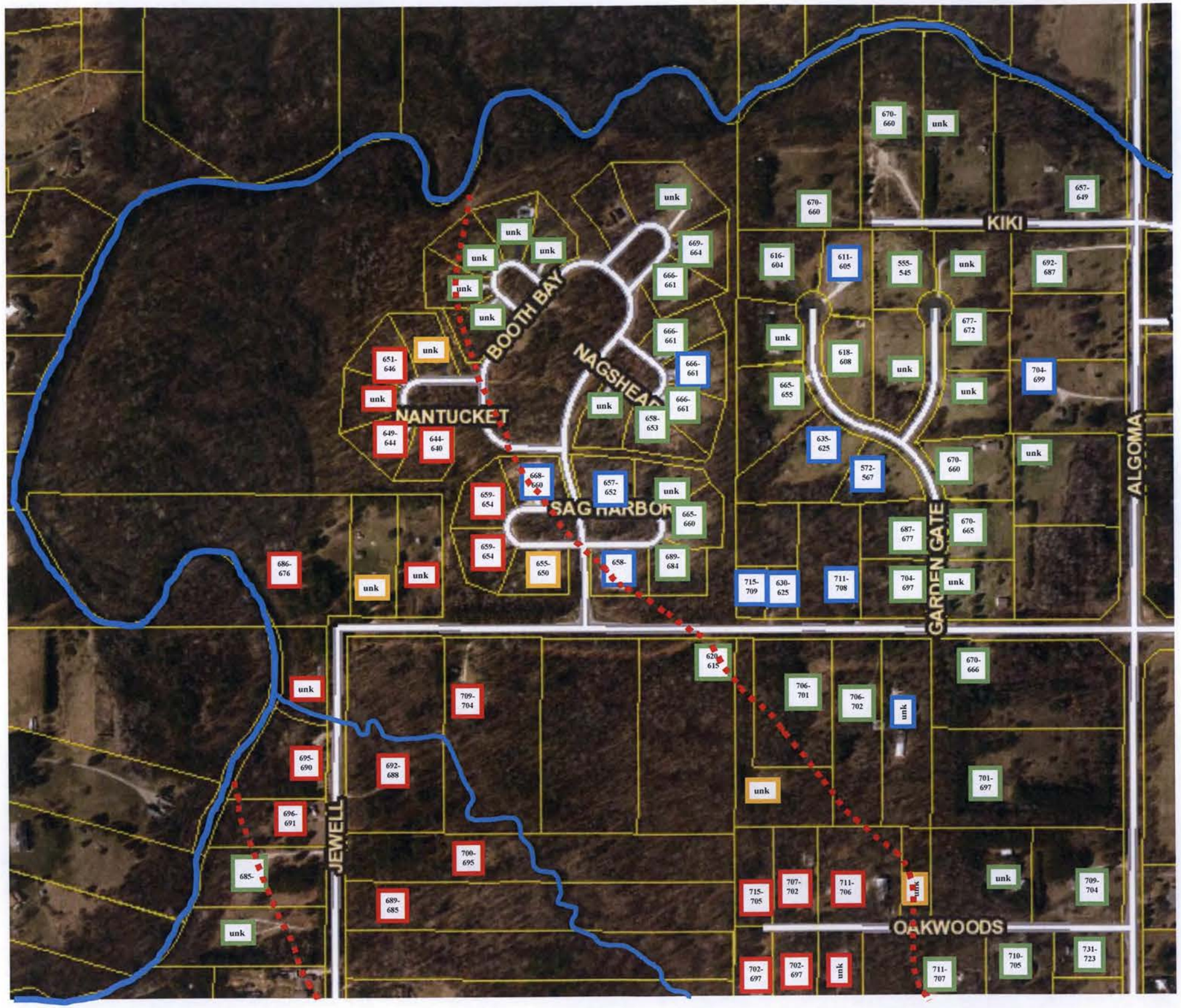


**Figure 2—PFOS/PFOA**

**Analysis of Drinking Water Well Results of the Primary Wolven-Jewell Plume**

**Algoma Township MI**

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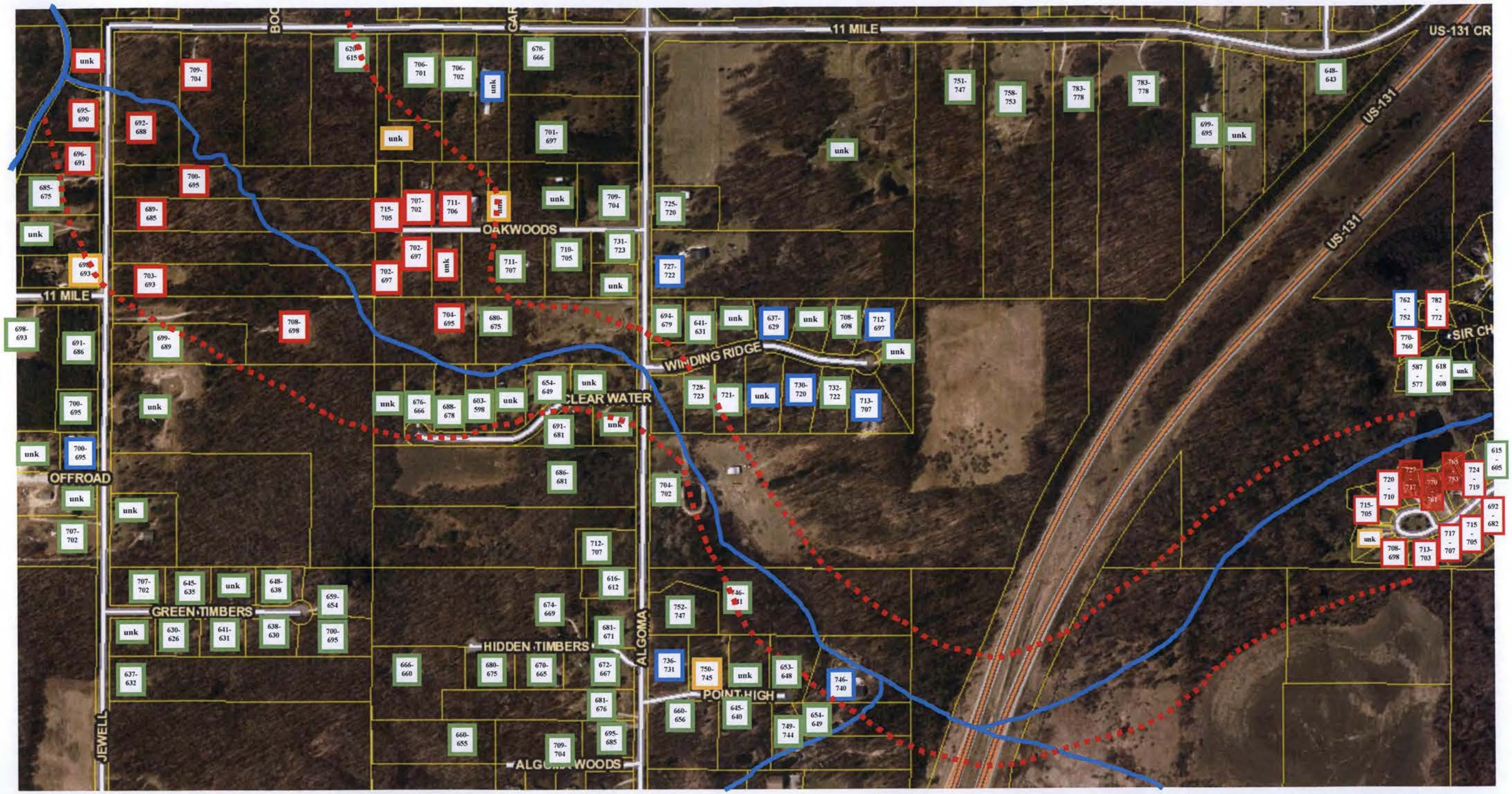


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**Figure 3—Total PFAS**

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**Algoma Township MI**

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**Note - Results are the initial sample results for the drinking water well**

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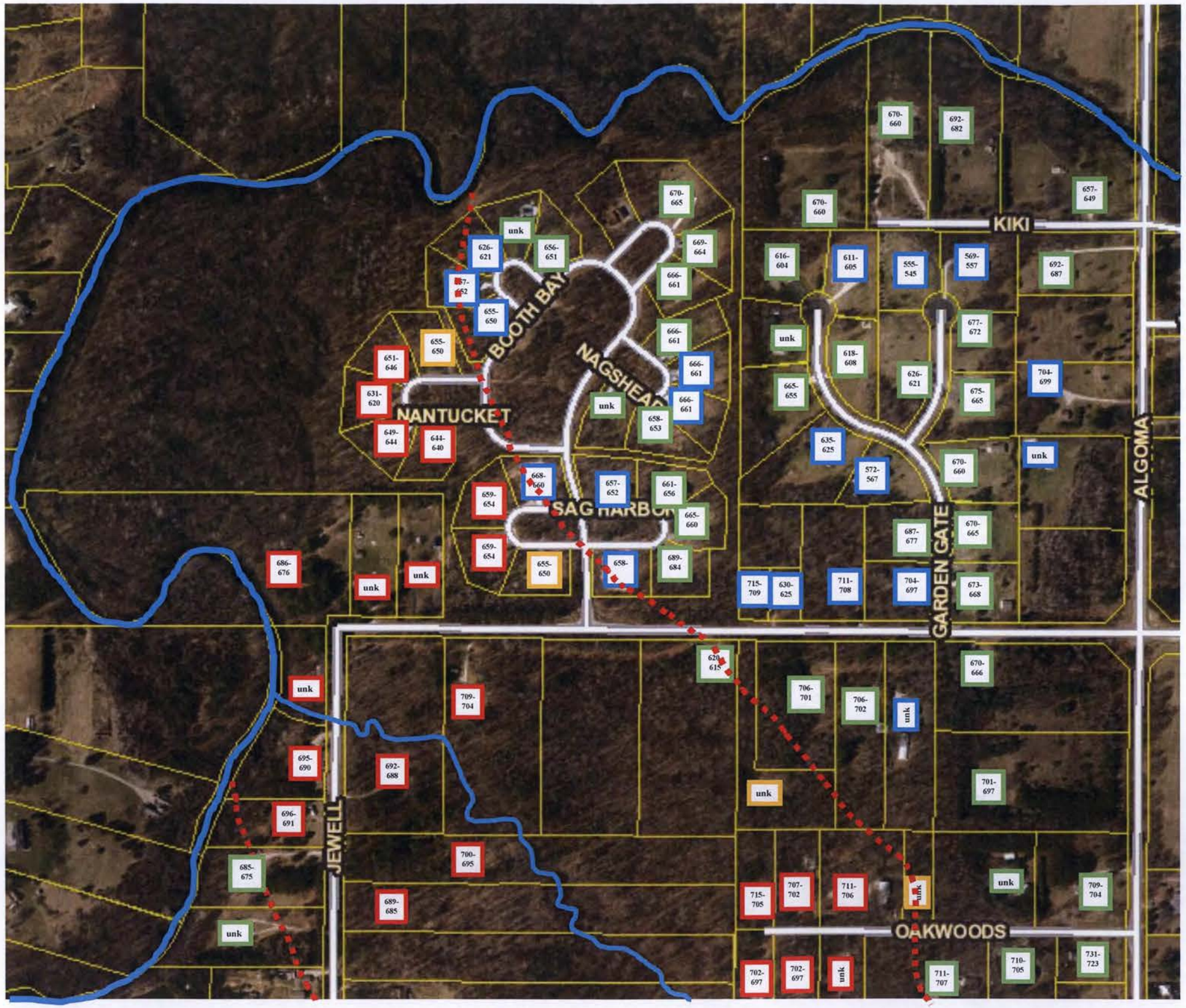


**Figure 4—Total PFAS**

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**Algoma Township MI**

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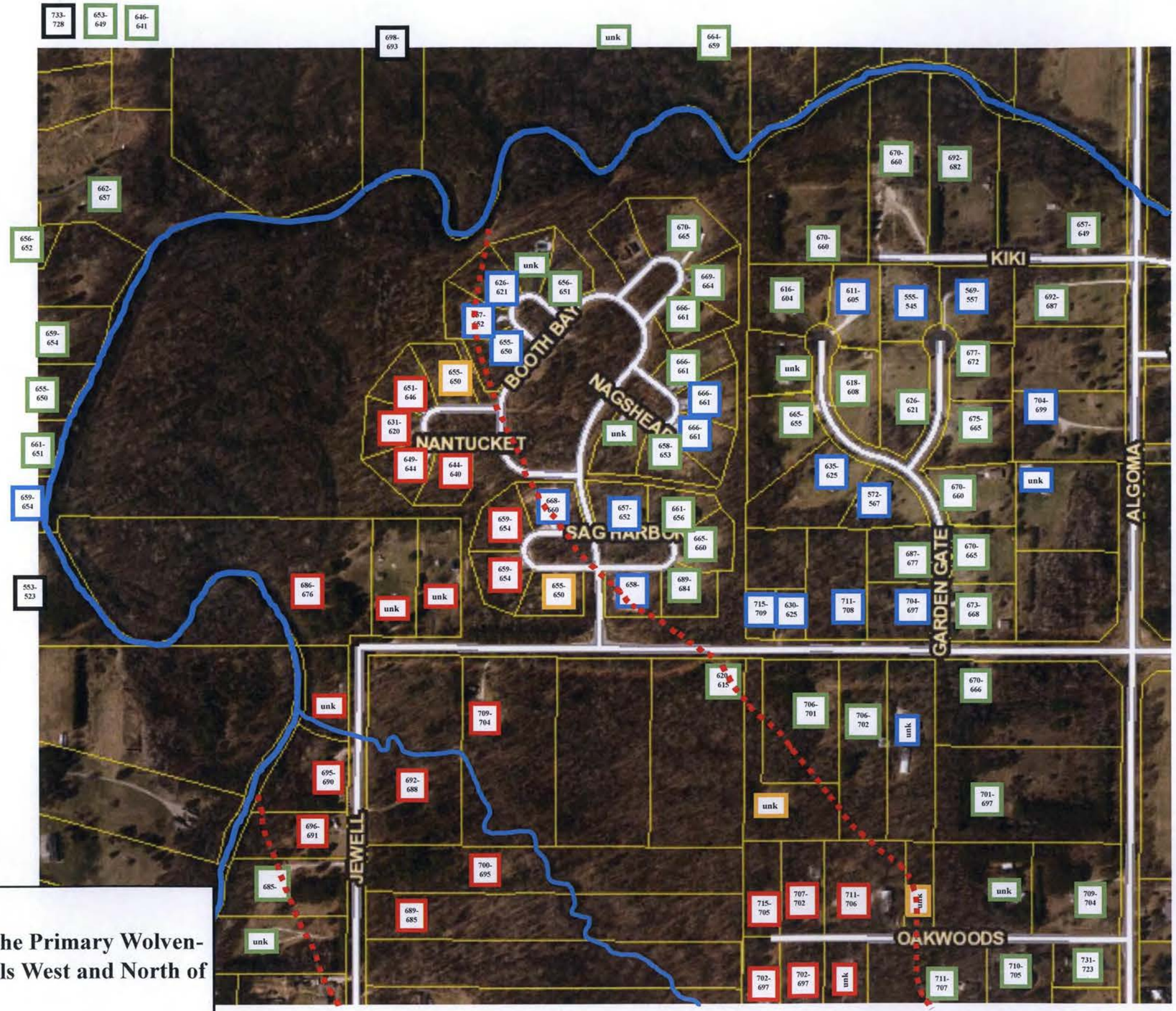


**Figure 5—Total PFAS**

**Analysis of Drinking Water Well Results of the Primary Wolven-Jewell Plume Including Drinking Water Wells West and North of the Rogue River**

**Algoma Township MI**

**Updated by the MDEQ-RRD-GR 11/27/2018**