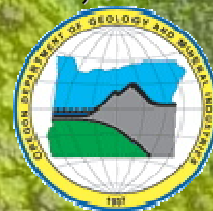


**LIDAR REMOTE SENSING DATA COLLECTION
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
WILLAMETTE VALLEY PHASE I, OREGON**

NOVEMBER 17, 2009

Submitted to:

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LIDAR REMOTE SENSING DATA COLLECTION:

DOGAMI, WILLAMETTE VALLEY PHASE I STUDY AREA

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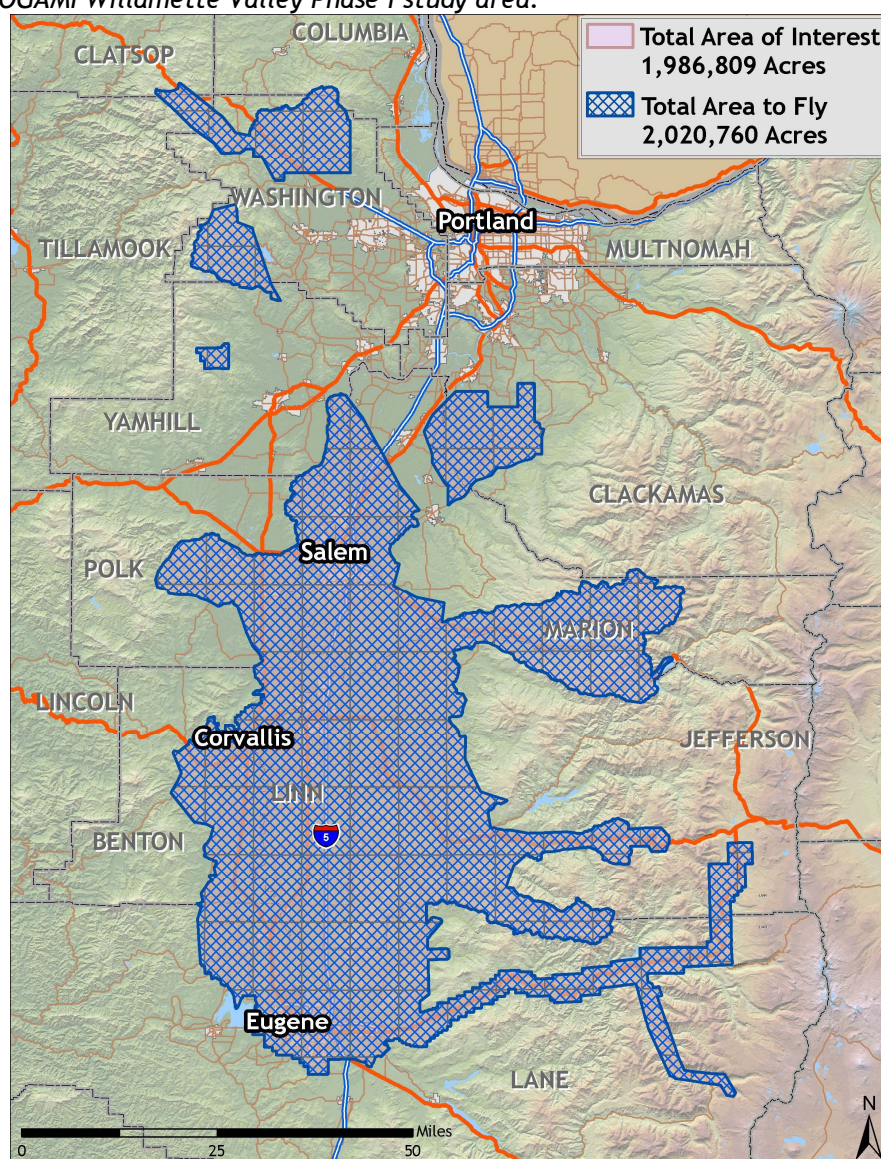
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1. Overview

1.1 Study Area (Willamette Valley Phase I)

Watershed Sciences, Inc. has collected Light Detection and Ranging (LiDAR) data of the Willamette Valley Phase I study area for the Oregon Department of Geology and Mineral Industries (DOGAMI). The complete area of interest (AOI) totals 3,104 square miles (1,986,809 acres) and the total area to fly (TAF) covers 3,157 square miles (2,020,760 acres). The TAF acreage is greater than the original AOI acreage due to buffering and flight planning optimization (**Figure 1.1** below). This report will be amended to reflect new data and cumulative statistics for the overall LiDAR survey with every delivery. DOGAMI data are *delivered* in OGIC(HARN): Projection: Oregon Statewide Lambert Conformal Conic; horizontal and vertical datums: NAD83 (HARN)/NAVD88(Geoid03); Units: International Feet.

Figure 1.1. DOGAMI Willamette Valley Phase I study area.



1.2 Area Delivered to Date

Total delivered acreage to date is detailed below.

DOGAMI Willamette Valley Phase I				
	Delivery Date	Acquisition Date	AOI Acres	TAF Acres
Delivery Area 1*	January 16, 2009	Oct. 22 - Oct. 24, 2008	30,472	32,150
Delivery Area 2	April 29, 2009	Aug. 31, 2008 - Feb. 22, 2009	66,377	67,377
Delivery Area 3	April 29, 2009	Aug. 31 - Sept. 14, 2008	88,466	89,974
Delivery Area 4	May 18, 2009	Aug. 31, 2008 - Feb. 22, 2009	136,997	136,997
Delivery Area 5	May 18, 2009	Aug. 31 - Sept. 14, 2008	136,424	136,424
Delivery Area 6	May 29, 2009	Aug. 31 - Sept. 21, 2008	157,008	157,904
Delivery Area 7	May 29, 2009	Aug. 31 - Sept. 21, 2008	64,771	65,249
Delivery Area 8	June 19, 2009	Aug. 31, 2008 - Apr. 5, 2009	151,639	155,491
Delivery Area 9	July 2, 2009	Sept. 14, 2008 - Mar. 3, 2009	146,621	147,742
Delivery Area 10	July 17, 2009	Oct. 5, 2008 - Mar. 15, 2009	123,871	125,480
Delivery Area 11	July 17, 2009	Oct. 5, 2008 - Nov. 11, 2008	88,153	89,804
Delivery Area 12	July 23, 2009	Sept. 28, 2008 - Mar. 15, 2009	86,943	89,161
Delivery Area 13	September 18, 2009	Sept. 17, 2008 - Jul. 01, 2009	173,501	177,375
Delivery Area 14	November 17, 2009	May 18, 2009 - Jun. 16, 2009	92,998	96,010
Total Acres			1,544,241	1,567,138

**Delivery area 14 adjoins north coast areas 7 and 8 (see image below). All stats for Willamette Valley Phase 1 area 14 will be reported in the north coast, area 7 and 8, data report.*

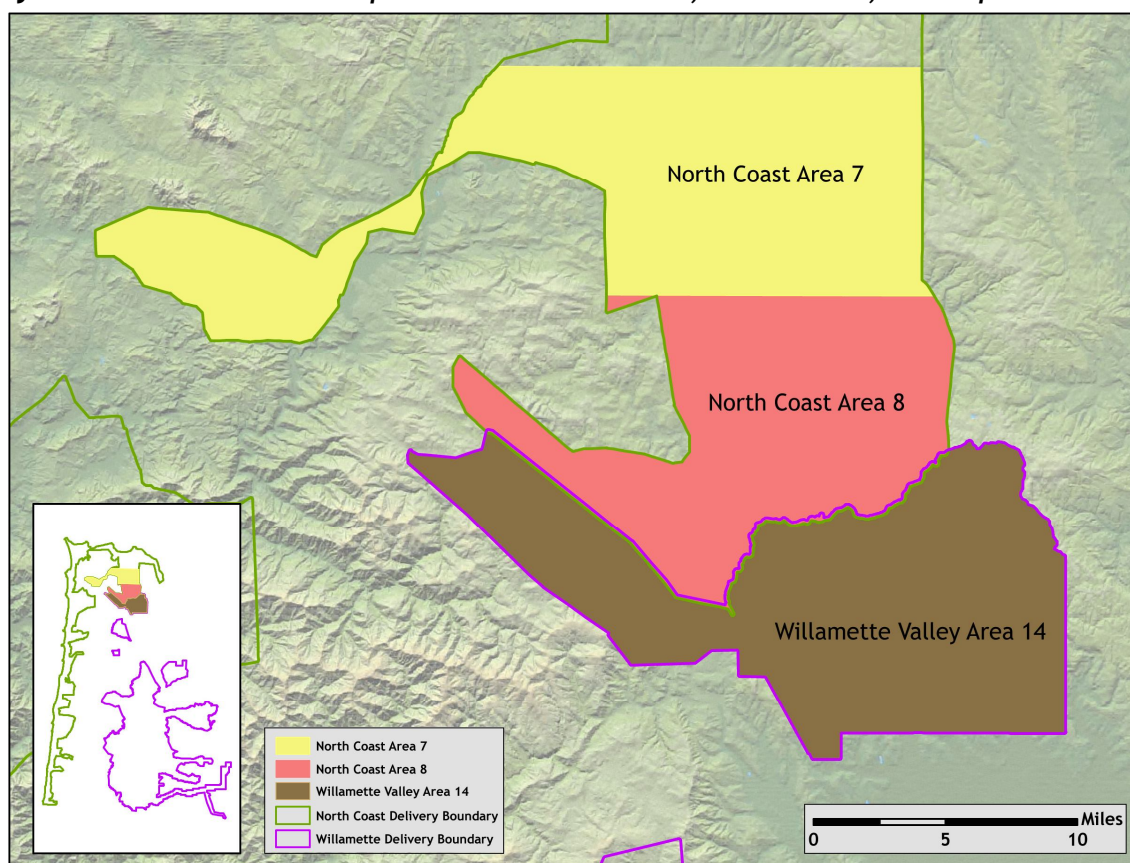
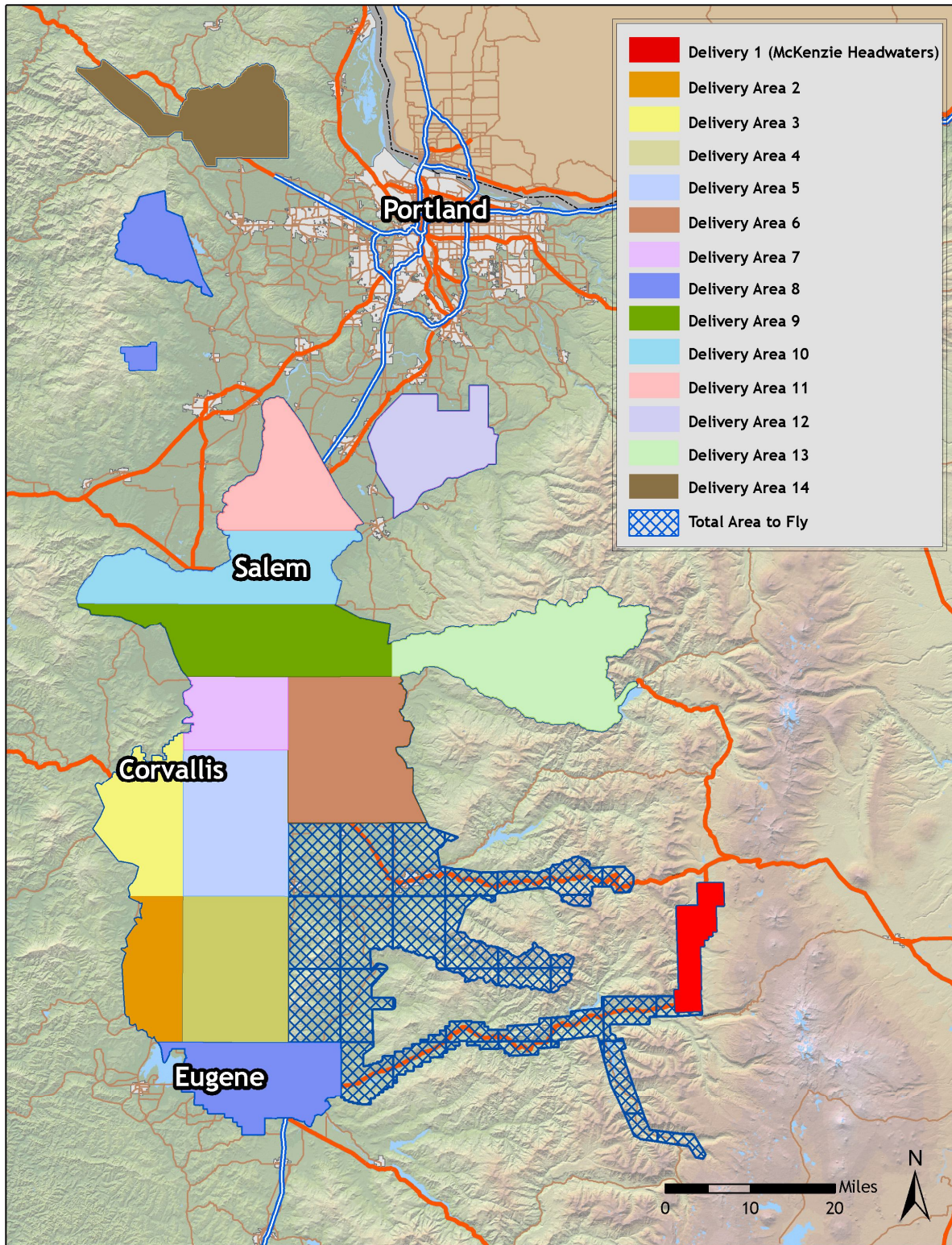
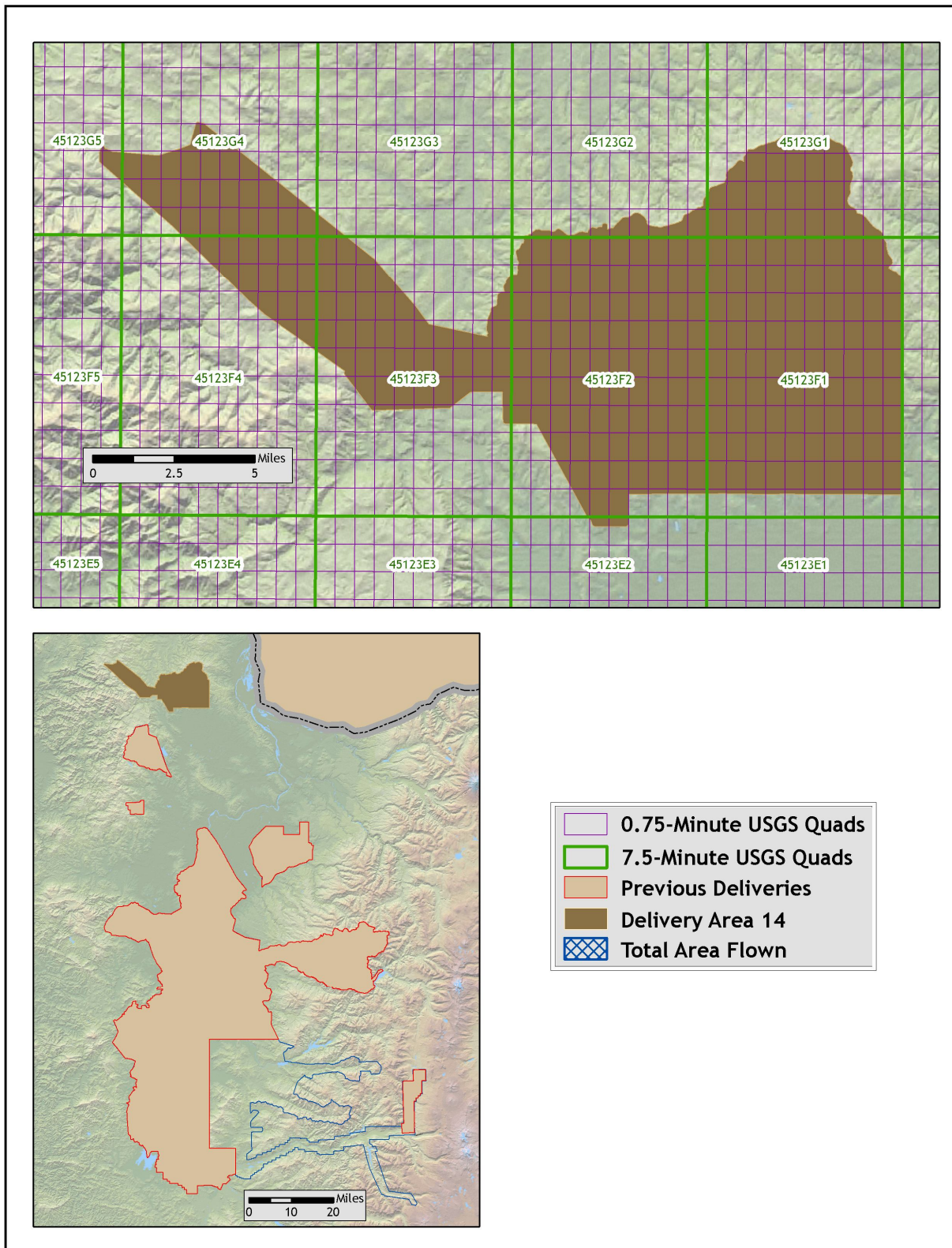


Figure 1.2. Willamette Valley Phase I study area, illustrating the delivered portions of the TAF.



*The data report for delivery area 1 was listed as the McKenzie Headwaters study area and delivered separately.

Figure 1.3. Willamette Valley Phase I study area, illustrating the delivered 0.75 and 7.5 minute USGS quads.



1.3 Acquisition and Ground Survey

LiDAR acquisition for delivery areas 2 through 14 occurred from August 31, 2008 - July 1, 2009 for the Willamette Valley Phase I study area.

Figure 1.4. Actual flightlines for the Willamette Valley Phase I study area illustrating the dates flown (based on GPS week).

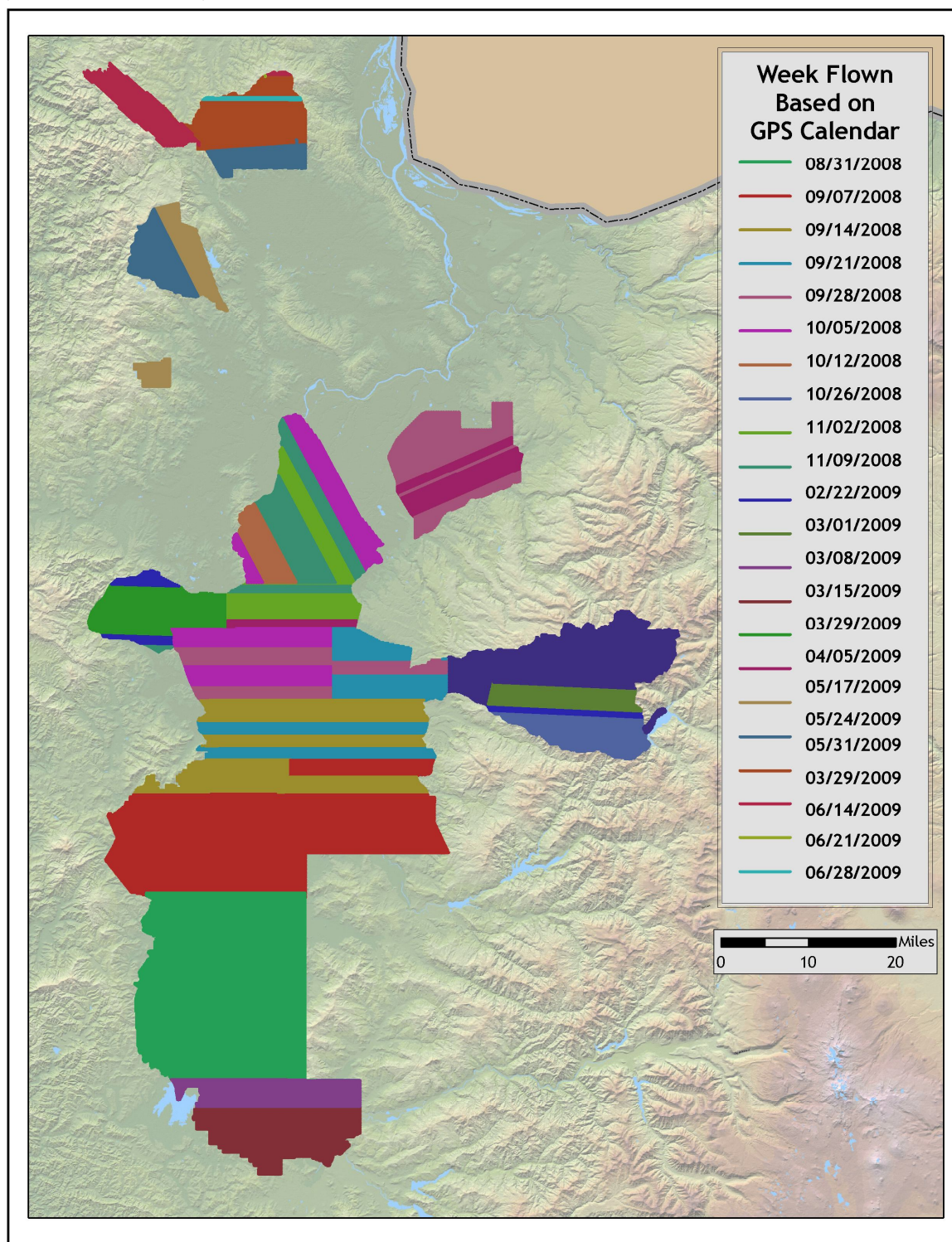
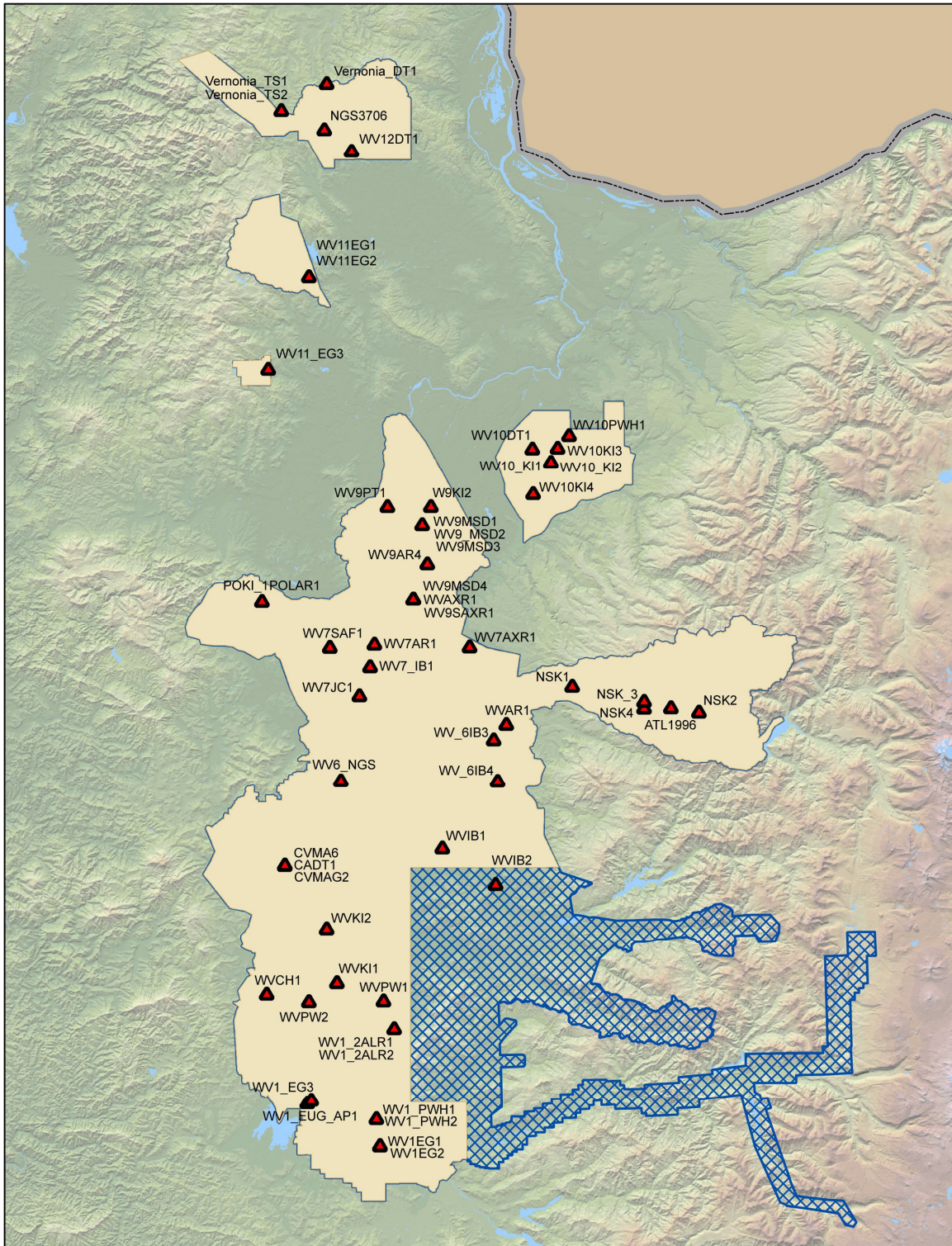


Figure 1.5. Base stations for the Willamette Valley Phase I study area for data delivered to date.



RTK for the delivery area 14 is reported in the north coast, delivery areas 7 and 8, report.

For data delivery areas 2 - 13, 31,156 RTK points were collected in the study area. Figures 1.6 - 1.13 show a detailed view of selected RTK locations per delivery.

Figure 1.6. RTK point locations in the study area for delivery areas 2 and 3; images are NAIP orthoimages.

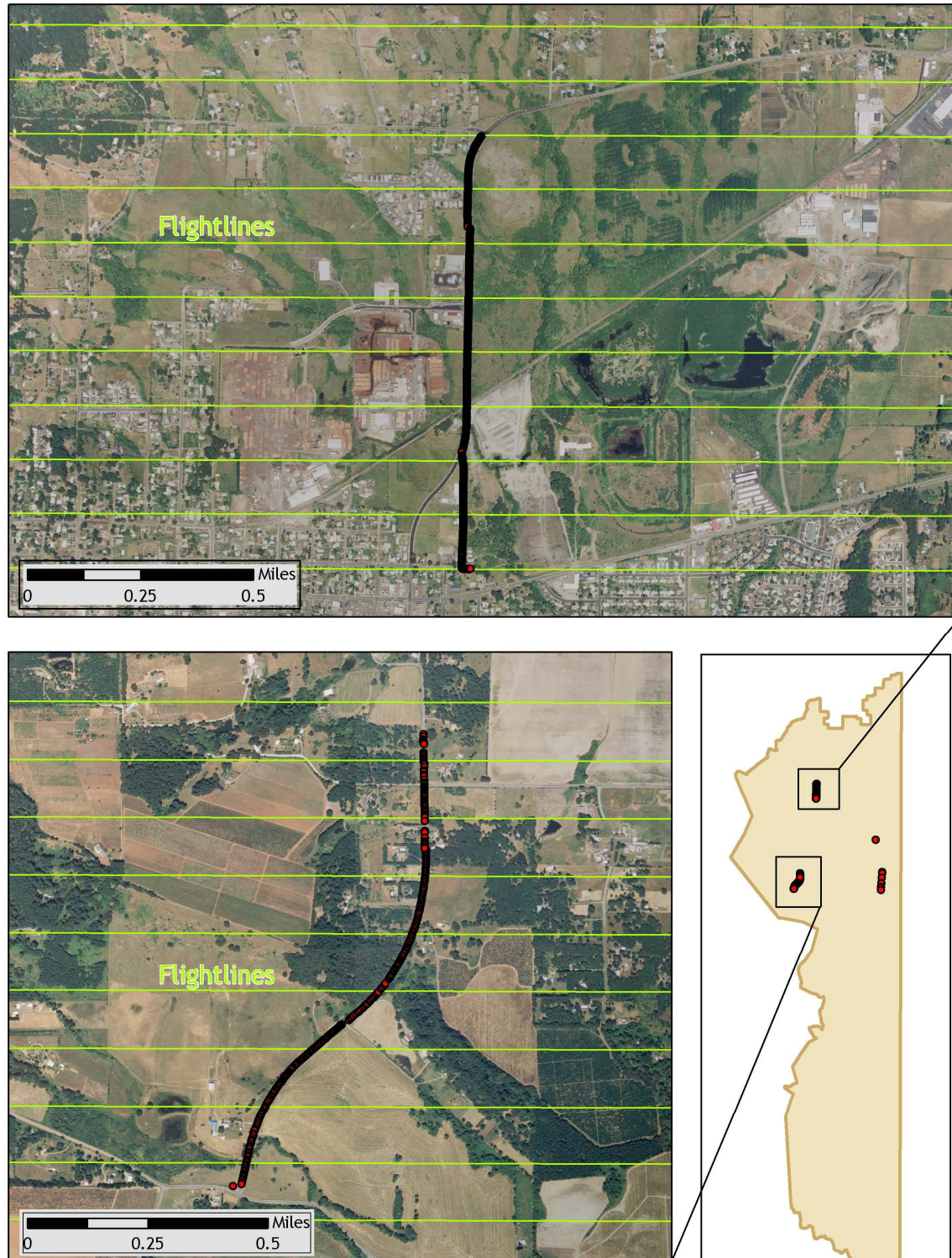


Figure 1.7. RTK point locations in the study area for delivery areas 4 and 5; images are NAIP orthoimages.



Figure 1.8. RTK point locations in the study area for delivery areas 6 and 7; images are NAIP orthoimages.

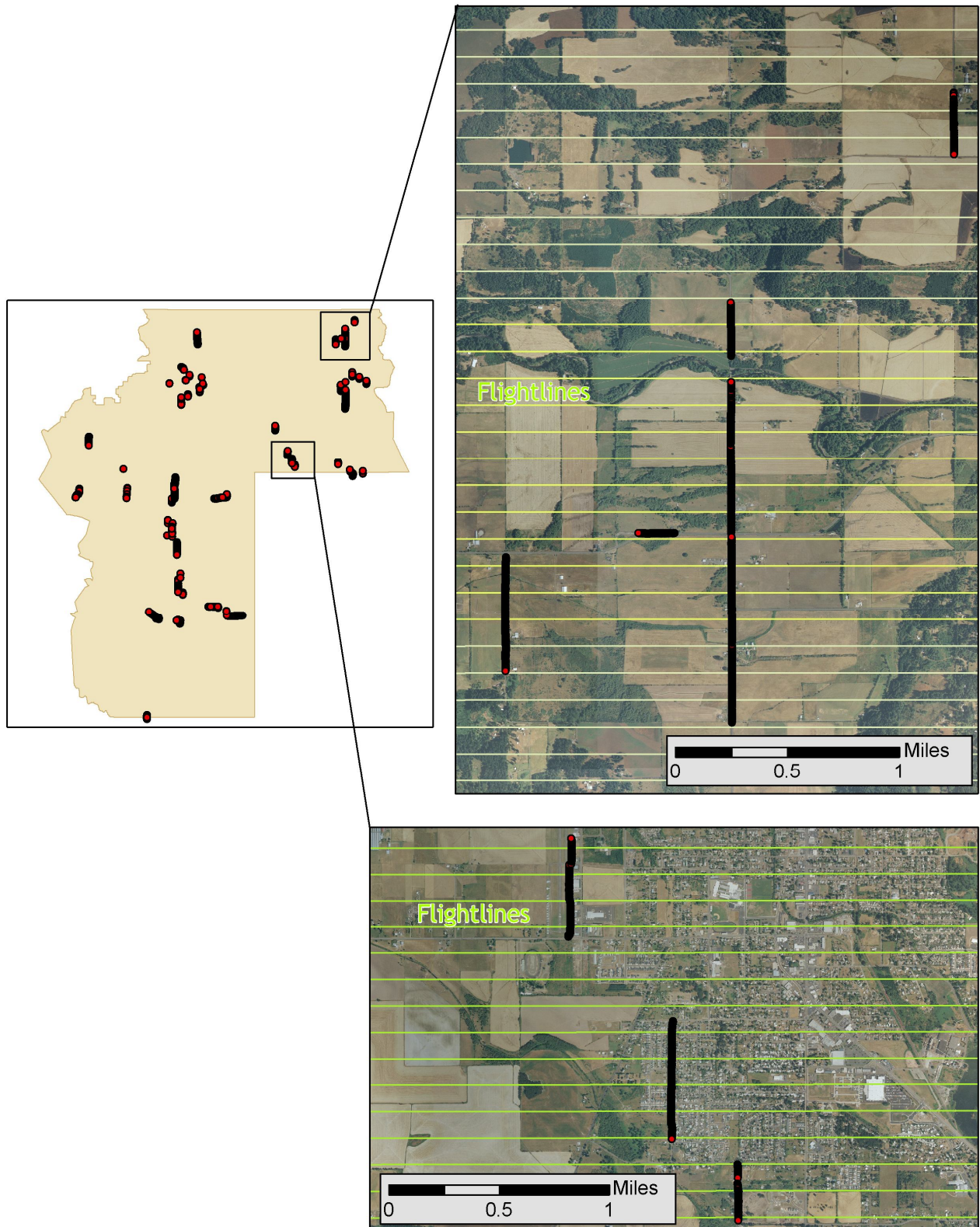


Figure 1.9. RTK point locations in the study area for delivery area 8; images are NAIP orthoimages.

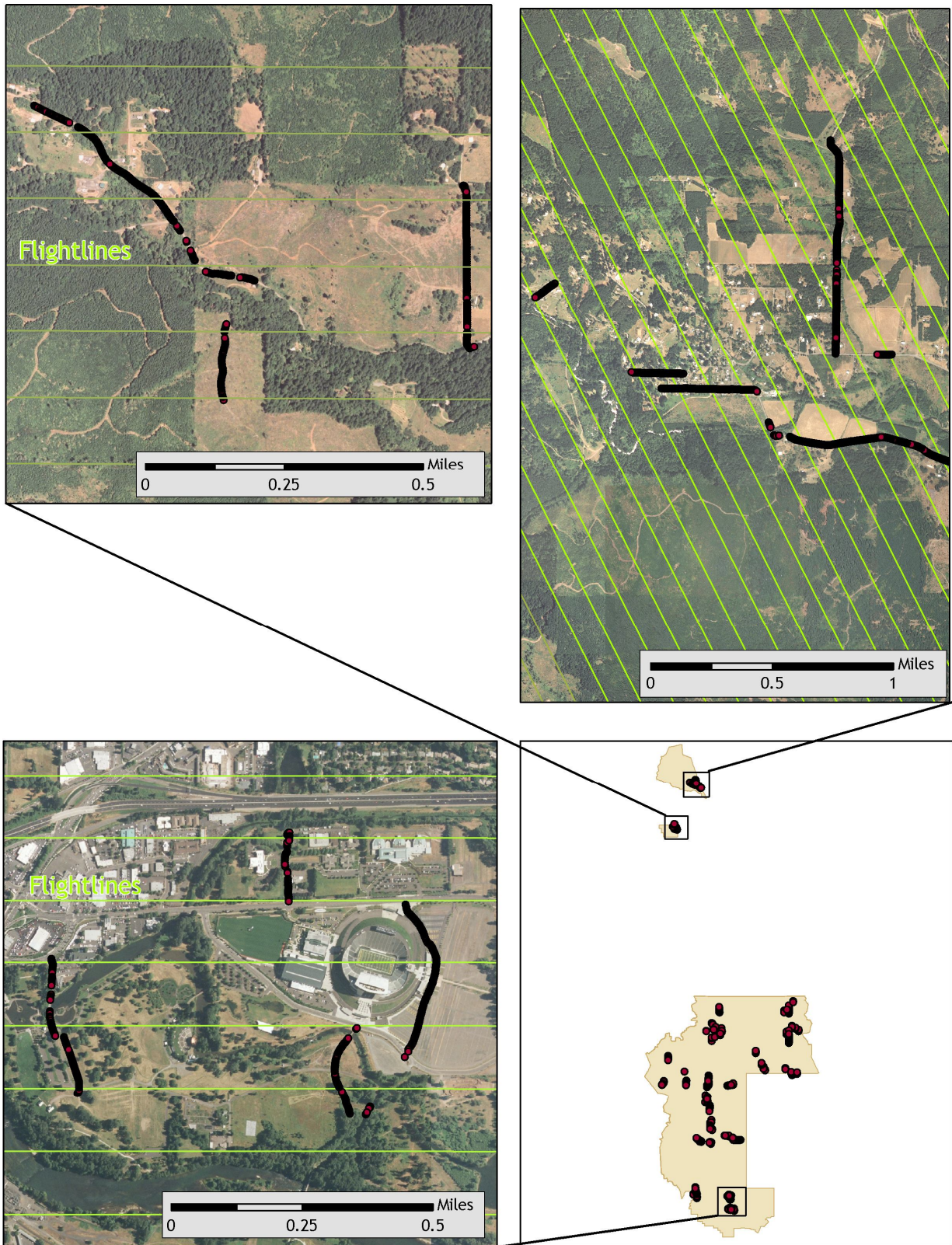


Figure 1.10. RTK point locations in the study area for delivery area 9; images are NAIP orthoimages.

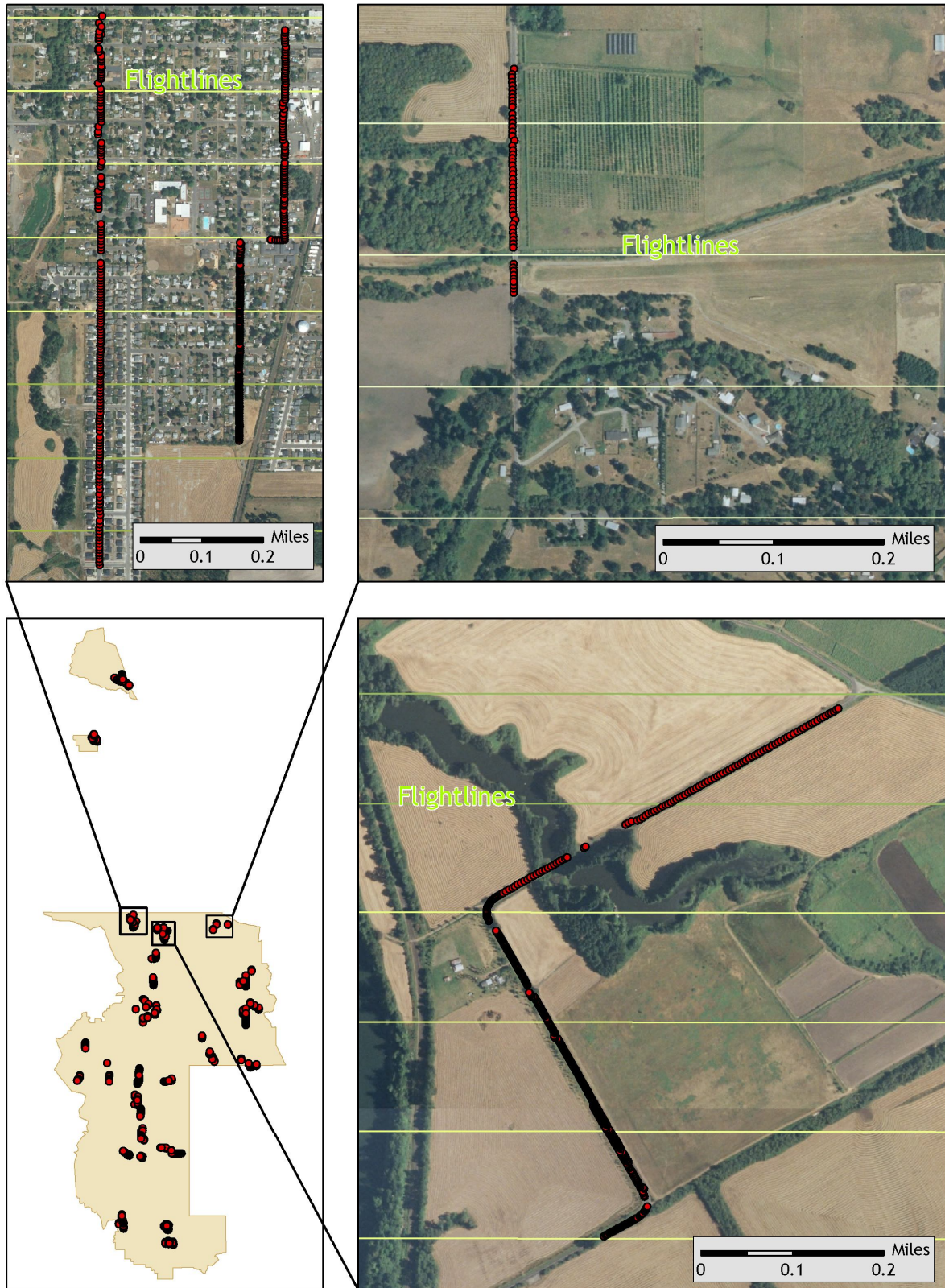


Figure 1.11. RTK point locations in the study area for delivery areas 10 and 11; images are NAIP orthoimages.

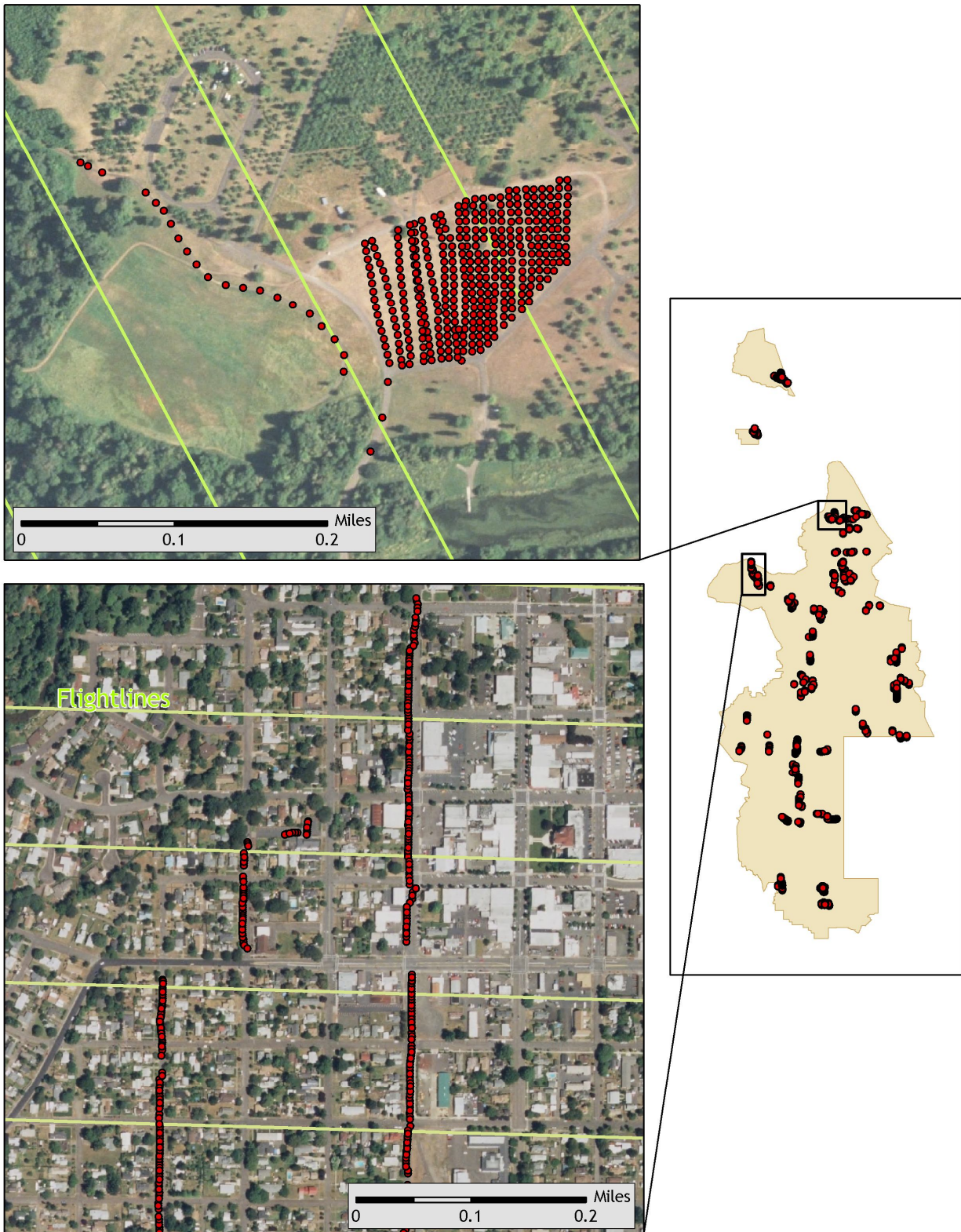


Figure 1.12. RTK point locations in the study area for delivery area 12; images are NAIP orthoimages.

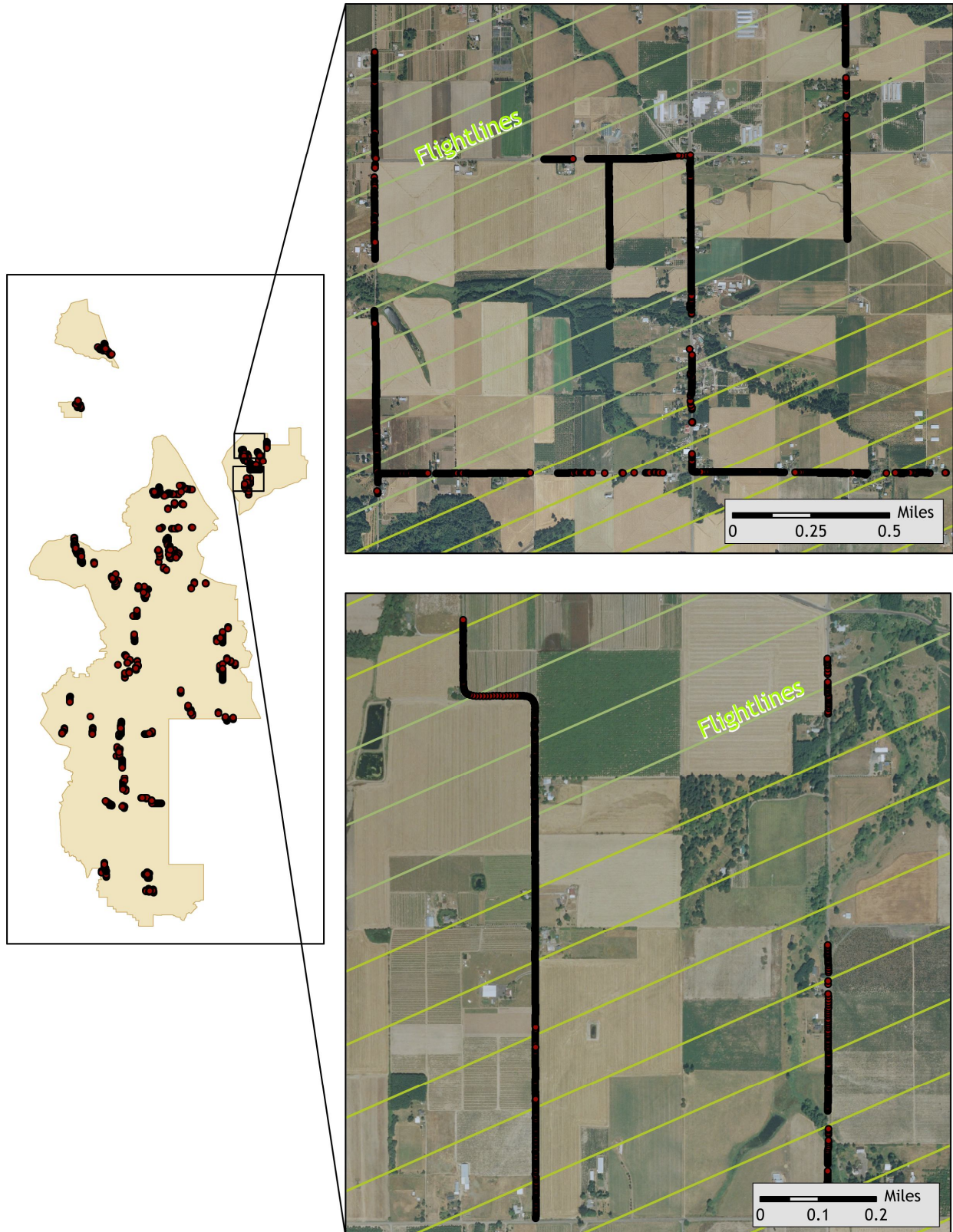


Figure 1.13. RTK point locations in the study area for delivery area 13; images are NAIP orthoimages.

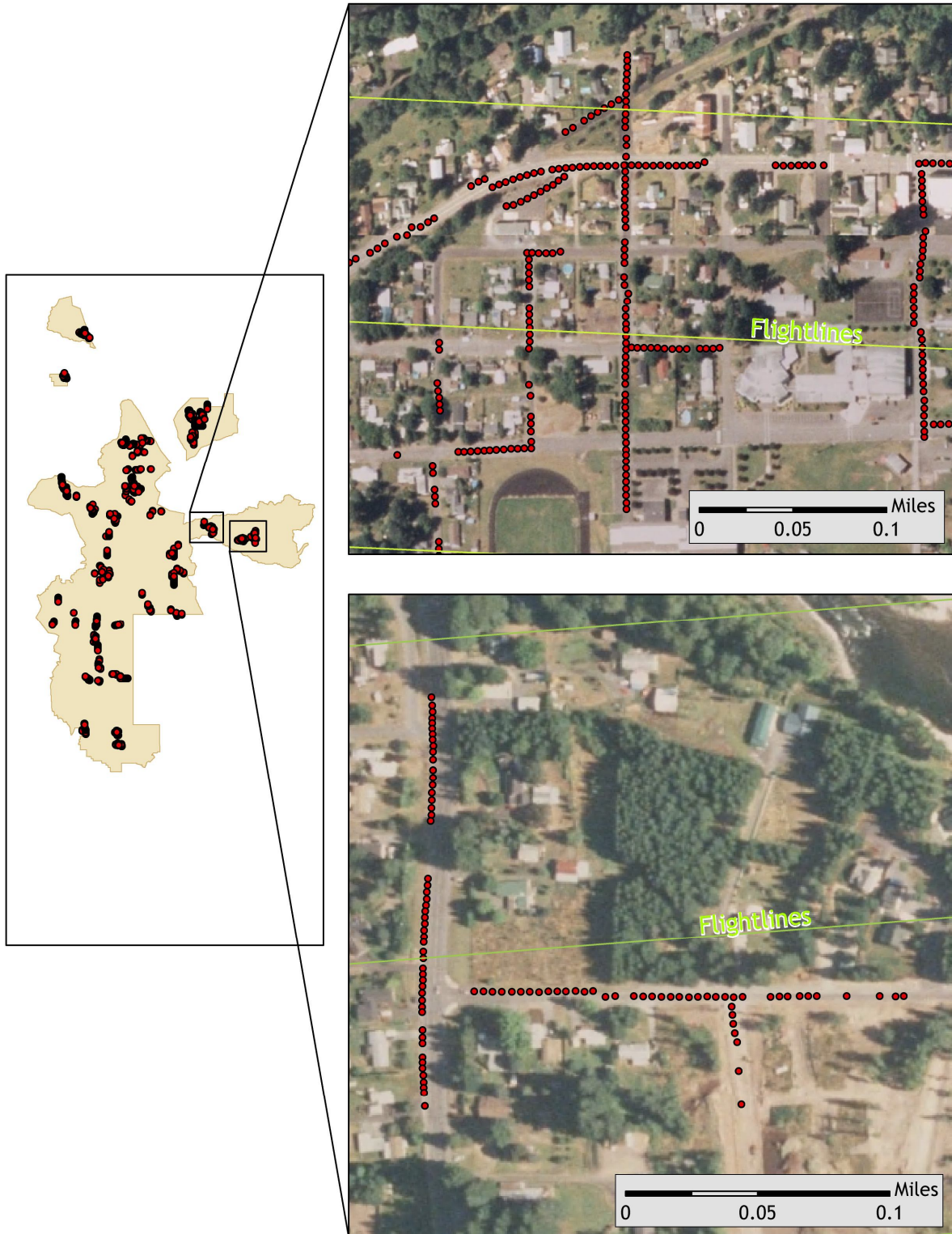


Table 1.1. Base Station Surveyed Coordinates, (NAD83/NAVD88, OPUS corrected) used for kinematic post-processing of the aircraft GPS data for the Willamette Valley Phase I study area.

Base Stations ID	Datum NAD83 (HARN)		GRS80
	Latitude (North)	Longitude (West)	Ellipsoid Height (m)
ATL1996	44 45 19.98896	122 24 51.99551	266.8315
CADT1	44 30 15.57786	123 16 52.94455	51.793
CVMA6	44 30 16.46154	123 16 53.14095	51.867
CVMAG2	44 30 15.85789	123 16 53.25330	51.829
NGS3706	45 41 00.77641	123 11 48.80841	58.01
NSK_3	44 45 56.88759	122 28 28.54717	387.869
NSK1	44 47 27.05807	122 38 09.58269	163.614
NSK2	44 44 53.11490	122 21 02.96038	443.5455
NSK4	44 45 18.59839	122 28 28.00832	239.4585
POKI_1	44 55 38.66110	123 20 07.38243	88.969
POLAR1	44 55 38.80490	123 20 07.11584	88.7995
Vernonia_DT1	45 45 27.55697	123 11 31.15795	270.445
Vernonia_TS1	45 42 51.50971	123 17 43.86203	323.289
Vernonia_TS2	45 42 51.45486	123 17 43.77242	323.323
W9KI2	45 04 47.45357	122 57 12.95446	32.1235
WV_6IB3	44 42 20.47071	122 48 46.07149	84.765
WV_6IB4	44 38 20.91651	121 48 13.88306	88.254
WV1_2ALR1	44 14 36.45653	123 02 11.12672	81.005
WV1_2ALR2	44 14 36.55739	123 02 11.34727	81.014
WV1_EG3	44 07 26.69109	123 13 47.27702	86.9345
WV1_EUG_AP1	44 07 43.07971	123 13 14.42012	86.614
WV1_PWH1	44 05 57.01460	123 04 31.39832	102.557
WV1_PWH2	44 05 57.06332	123 04 31.40301	102.522
WV10_KI1	45 09 03.09445	122 40 54.82179	42.712
WV10_KI2	45 09 03.06309	122 40 55.13837	42.714
WV10DT1	45 10 21.41315	122 43 26.30645	32.3135
WV10KI3	45 10 24.88975	122 39 59.50283	49.843
WV10KI4	45 05 59.95580	122 43 21.11231	44.427
WV10PWH1	45 11 37.03389	122 38 26.38199	51.351
WV11_EG3	45 17 56.90350	123 19 22.02585	117.419
WV11EG1	45 26 52.94610	123 13 52.53149	52.164
WV11EG2	45 26 53.12241	123 13 52.49865	52.2235
WV12DT1	45 38 56.98416	123 08 04.69567	44.2085
WV1EG1	44 03 20.01625	123 04 02.53405	105.251
WV1EG2	44 03 20.18440	123 04 02.75328	105.148
WV6_NGS	44 38 23.26248	123 09 22.19571	43.629

(Table 1.1 continued on next page)

(Table 1.1 continued from previous page)

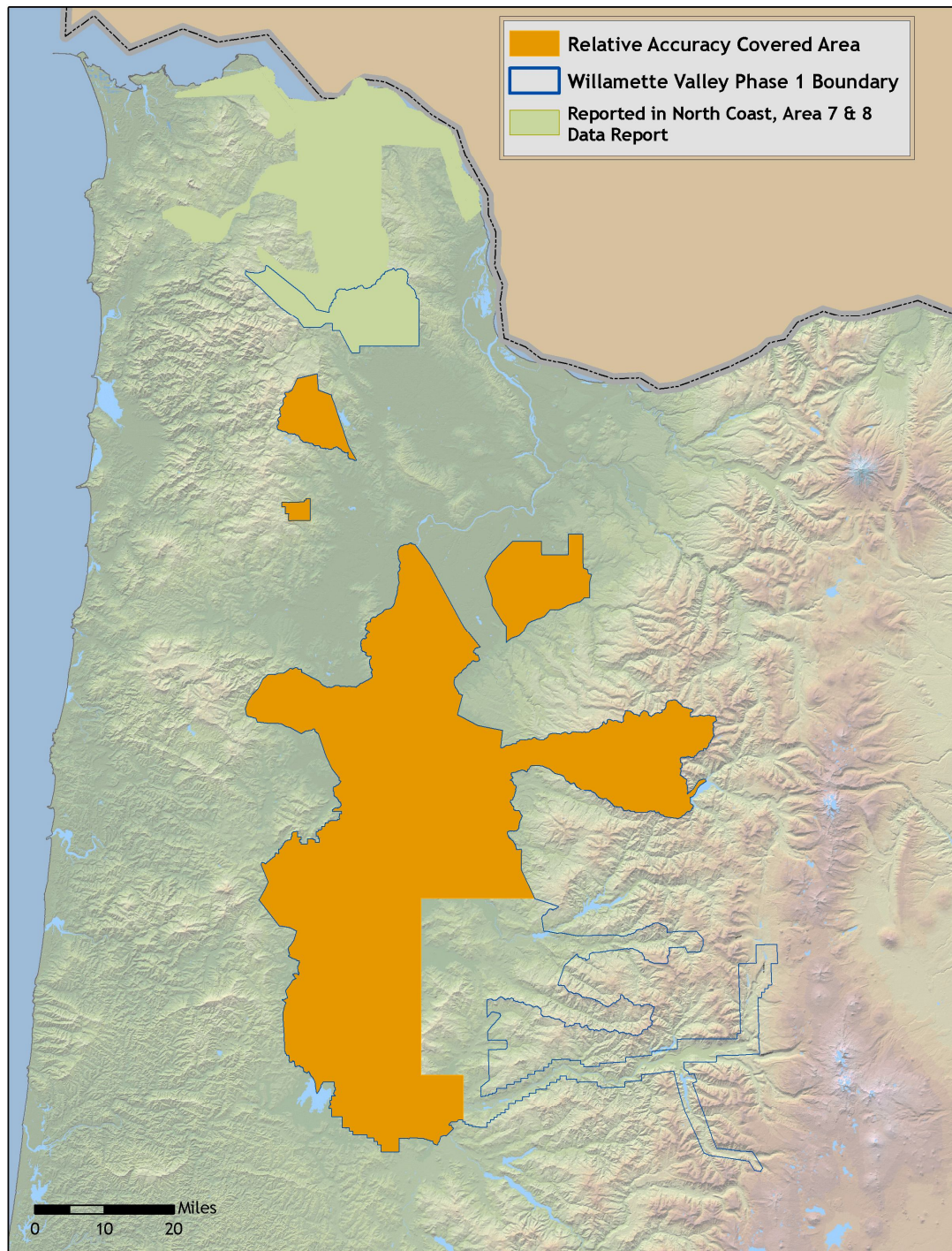
Table 1.1. Base Station Surveyed Coordinates, (NAD83/NAVD88, OPUS corrected) used for kinematic post-processing of the aircraft GPS data for the Willamette Valley Phase I study area.

Base Stations ID	Datum NAD83 (HARN)		GRS80
	Latitude (North)	Longitude (West)	Ellipsoid Height (m)
WV7_IB1	44 49 19.41580	123 05 25.72185	52.3175
WV7AR1	44 51 29.95230	123 04 52.60626	158.014
WV7AXR1	44 51 13.15065	122 51 59.69020	91.498
WV7JC1	44 46 34.37419	123 06 52.58730	31.406
WV7SAF1	44 51 10.56684	123 10 54.74948	22.448
WV9_MSD2	45 3 2.15144	122 58 24.20333	33.38
WV9AR4	44 59 16.29804	122 57 42.58599	33.599
WV9MSD1	45 03 02.06370	122 58 24.26463	33.342
WV9MSD3	45 3 2.15144	122 58 24.20303	33.351
WV9MSD4	44 55 54.05524	122 59 36.96889	37.1705
WV9PT1	45 4 46.51945	123 03 07.74202	11.118
WV9SAXR1	44 55 53.93185	122 59 35.68529	37.318
WVAR1	44 43 48.10903	122 47 02.71423	221.035
WVAXR1	44 55 54.07364	122 59 36.83714	37.1935
WVCH1	44 17 52.00532	123 19 13.83016	92.247
WVIB1	44 31 55.68533	122 55 41.88412	82.45
WVIB2	44 28 27.17988	122 48 32.92656	118.736
WVKI1	44 18 59.69538	123 09 49.49224	67.228
WVKI2	44 24 11.82167	123 11 14.29976	60.707
WVPW1	44 17 14.12051	123 03 36.07969	74.103
WVPW2	44 17 10.74383	123 13 33.86193	66.538

2. Accuracy

2.1 Relative Accuracy

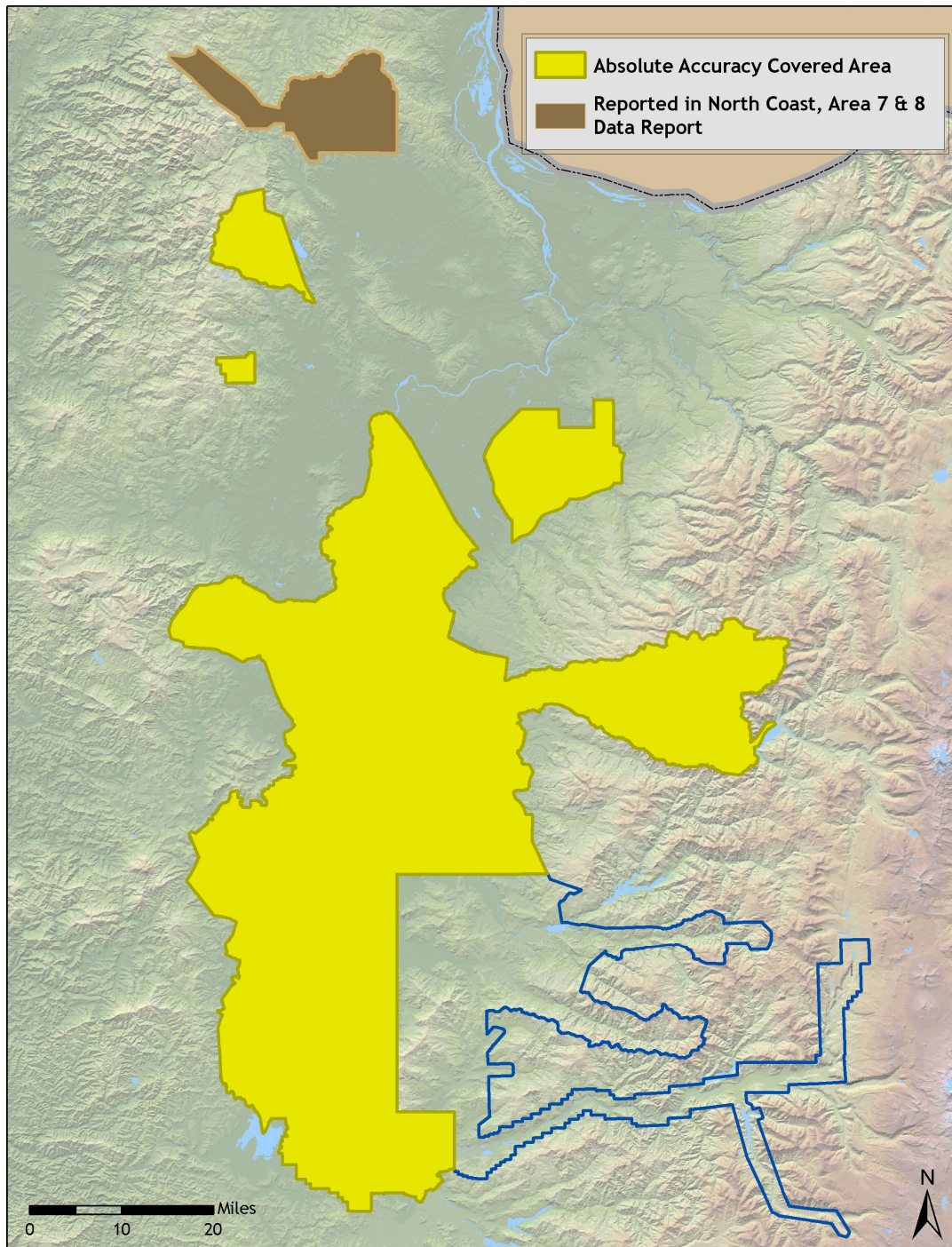
Relative accuracy calibration statistics for delivery area 14 were reported in the north coast, delivery areas 7 and 8, data report.



2.2 Absolute Accuracy

Absolute accuracy compares known Real Time Kinematic (RTK) ground survey points to the closest laser point. For the Willamette Valley Phase I Study Area, 31,156 RTK points were collected for deliveries 2 - 13. Absolute accuracy for delivery area 14 is reported in the north coast, delivery areas 7 and 8, data report. Area covered by absolute accuracy is show in **Figure 2.2**.

Figure 2.2. *Absolute Accuracy Covered Area.*



3. Data Density/Resolution

3.1 Density Statistics

Data density statistics for area 14 are reported in the north coast, areas 7 and 8, data report.

Some types of surfaces (i.e., dense vegetation or water) may return fewer pulses than the laser originally emitted. Therefore, the delivered density can be less than the native density and vary according to distributions of terrain, land cover and water bodies.

3.2 Selected Samples of Data Density/Resolution

Figure 3.1. Quadrants containing high pulse density classified points include areas with sparse vegetations such as clear cuts and agricultural fields or areas with overlapping flightlines.

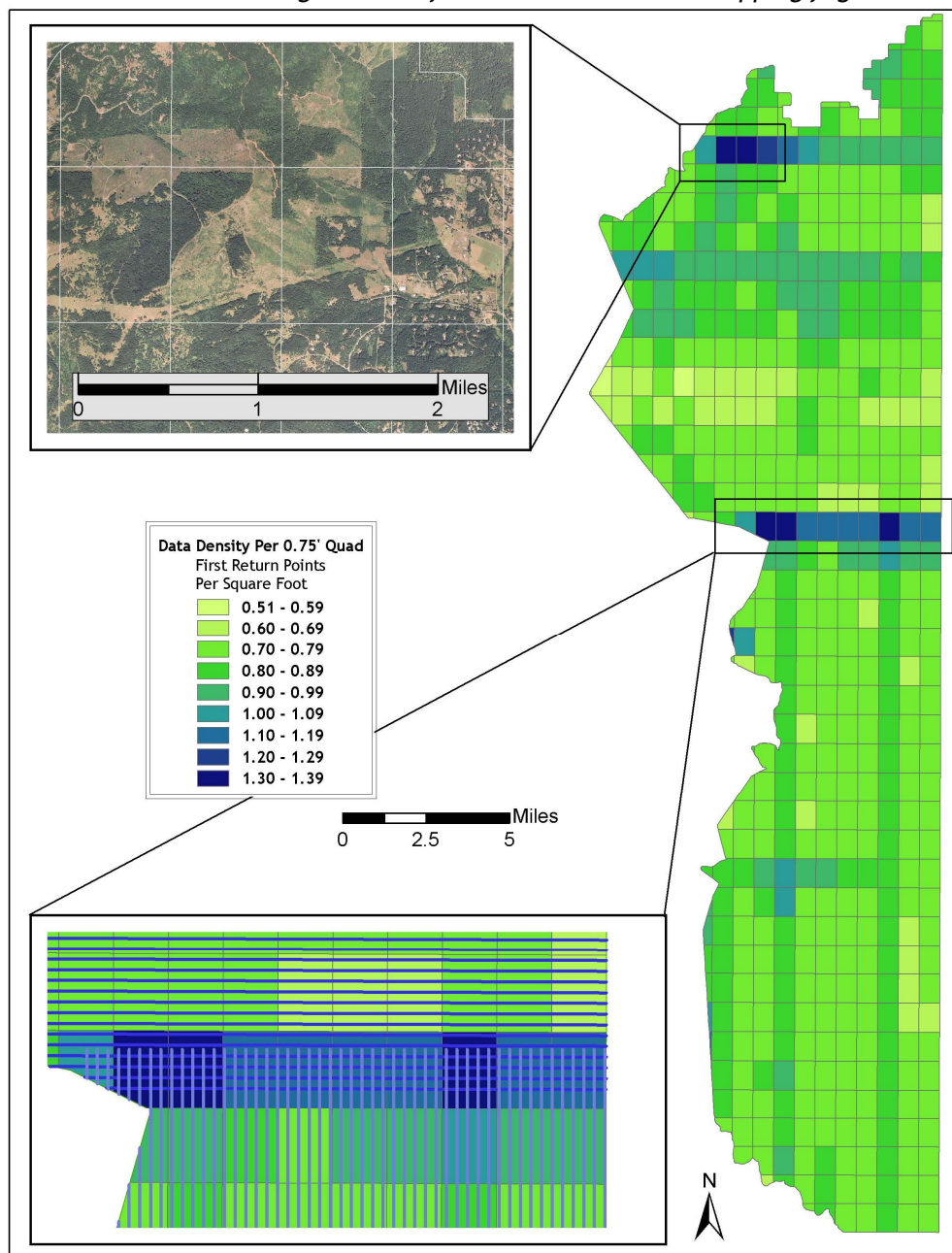


Figure 3.2. Quadrants containing low pulse density classified points include water bodies and shorelines.

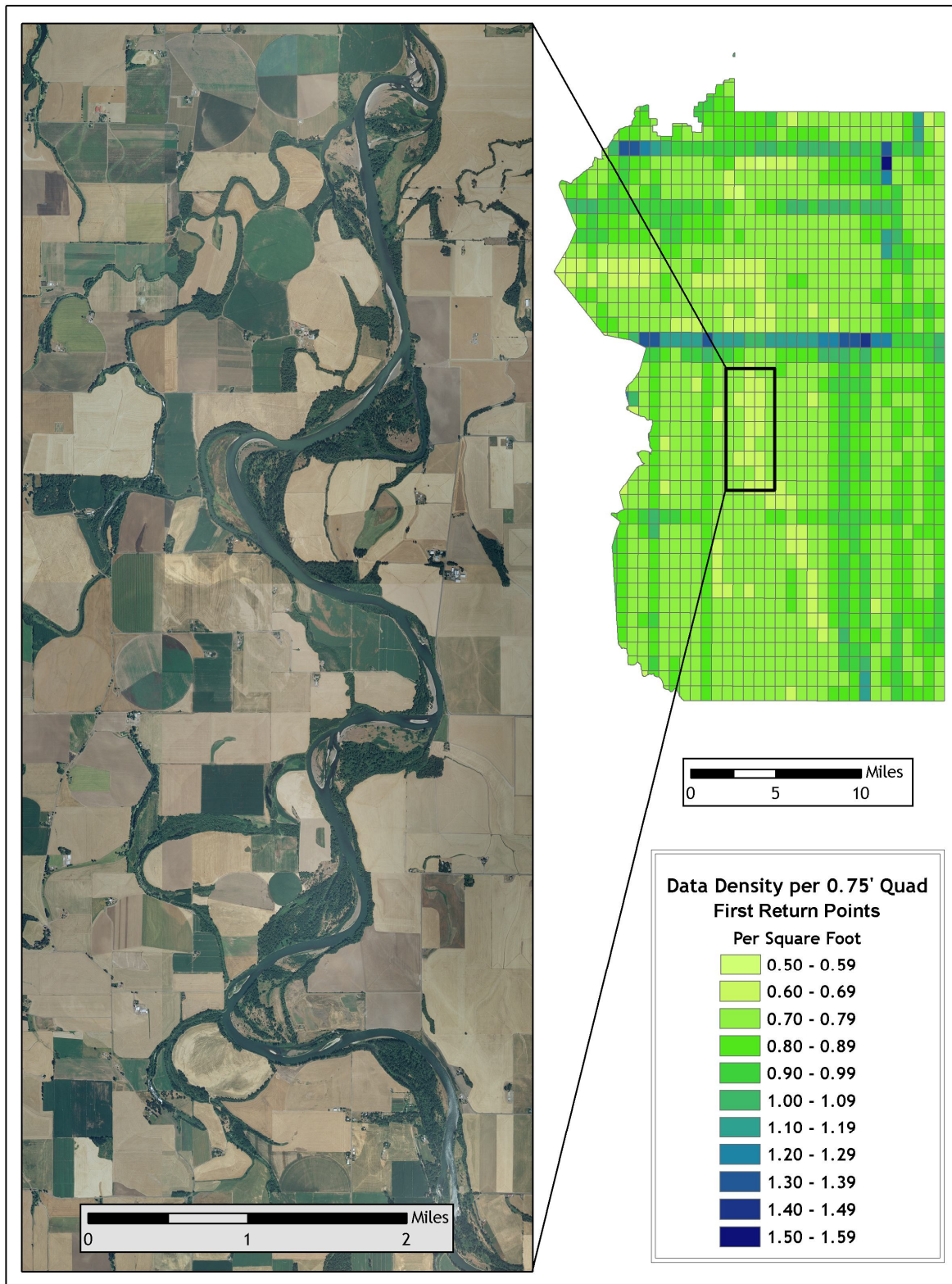
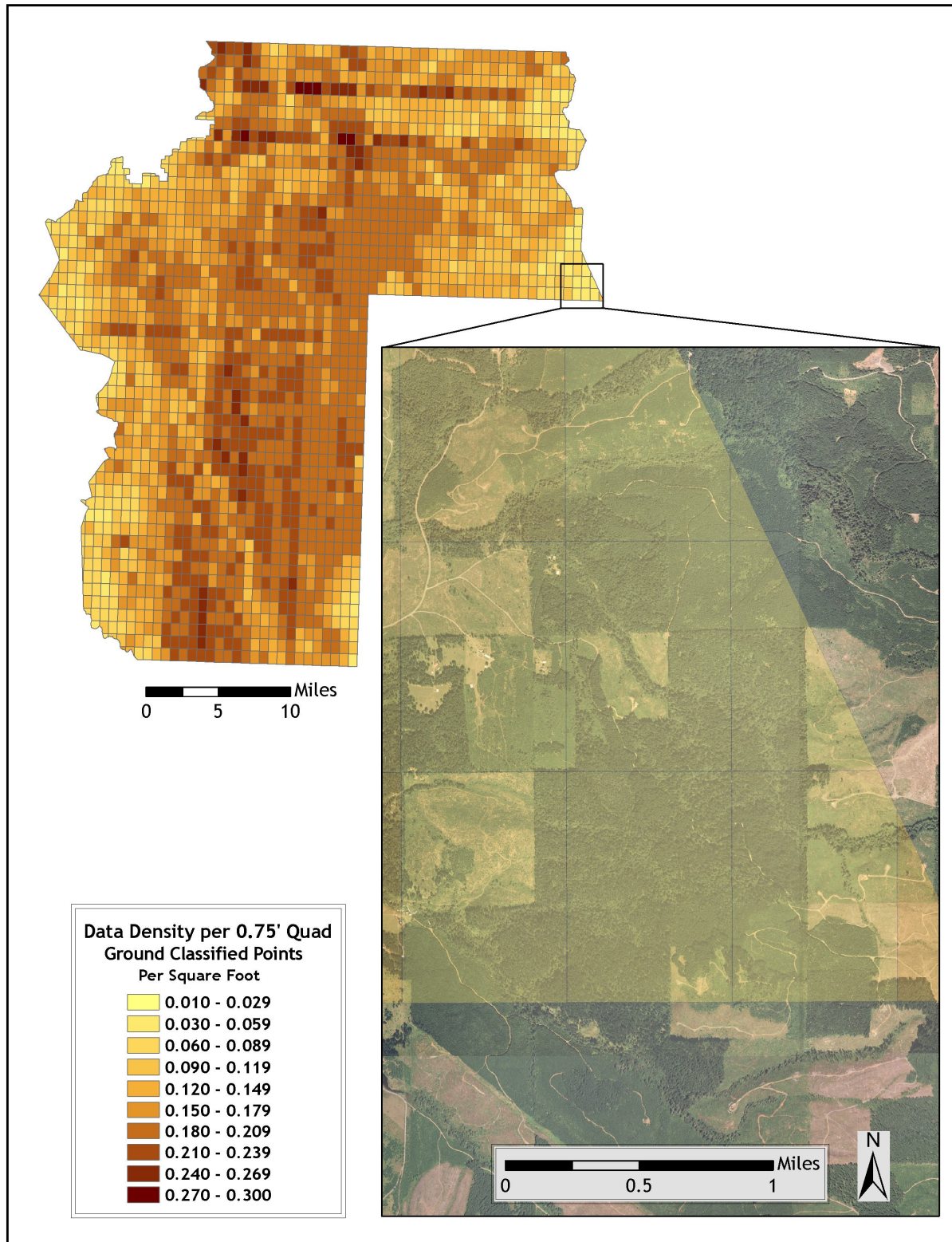


Figure 3.3. Quadrants containing lower pulse density classified points include densely vegetated areas.



4. Selected Imagery

Example areas are presented to show sample imagery (see **Figures 4.1-4.8**).

Figure 4.1. Oxbow on the Santiam River south of the town of Jefferson, Oregon (Quadrangle 44123F1).



Figure 4.2. Von Reservoir located in the Siuslaw National Forest in Oregon (Quadrangle 45123C3).

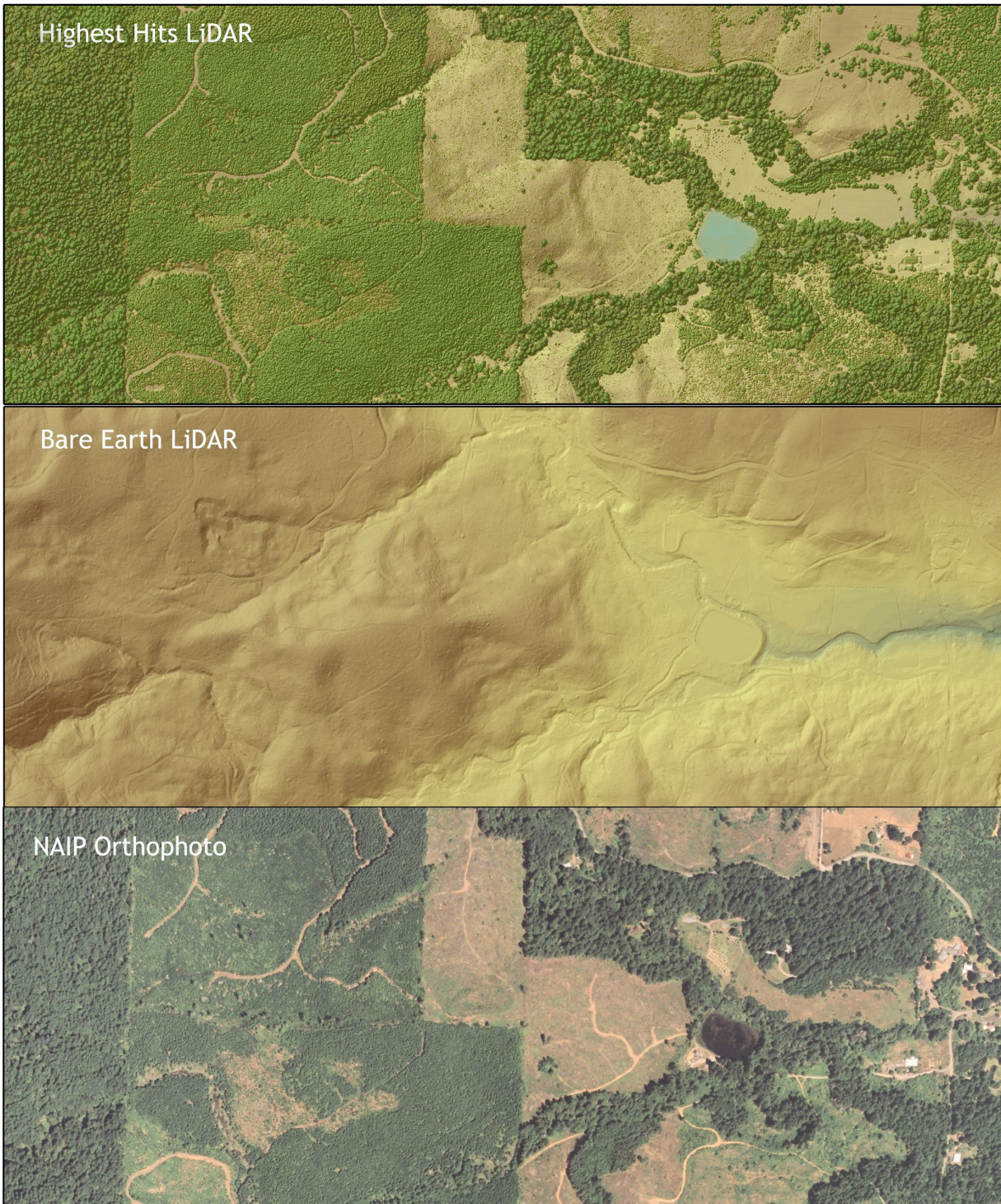


Figure 4.3. Hillsboro Reservoir located southwest of Forest Grove in Oregon (Quadrangle 45123D3).

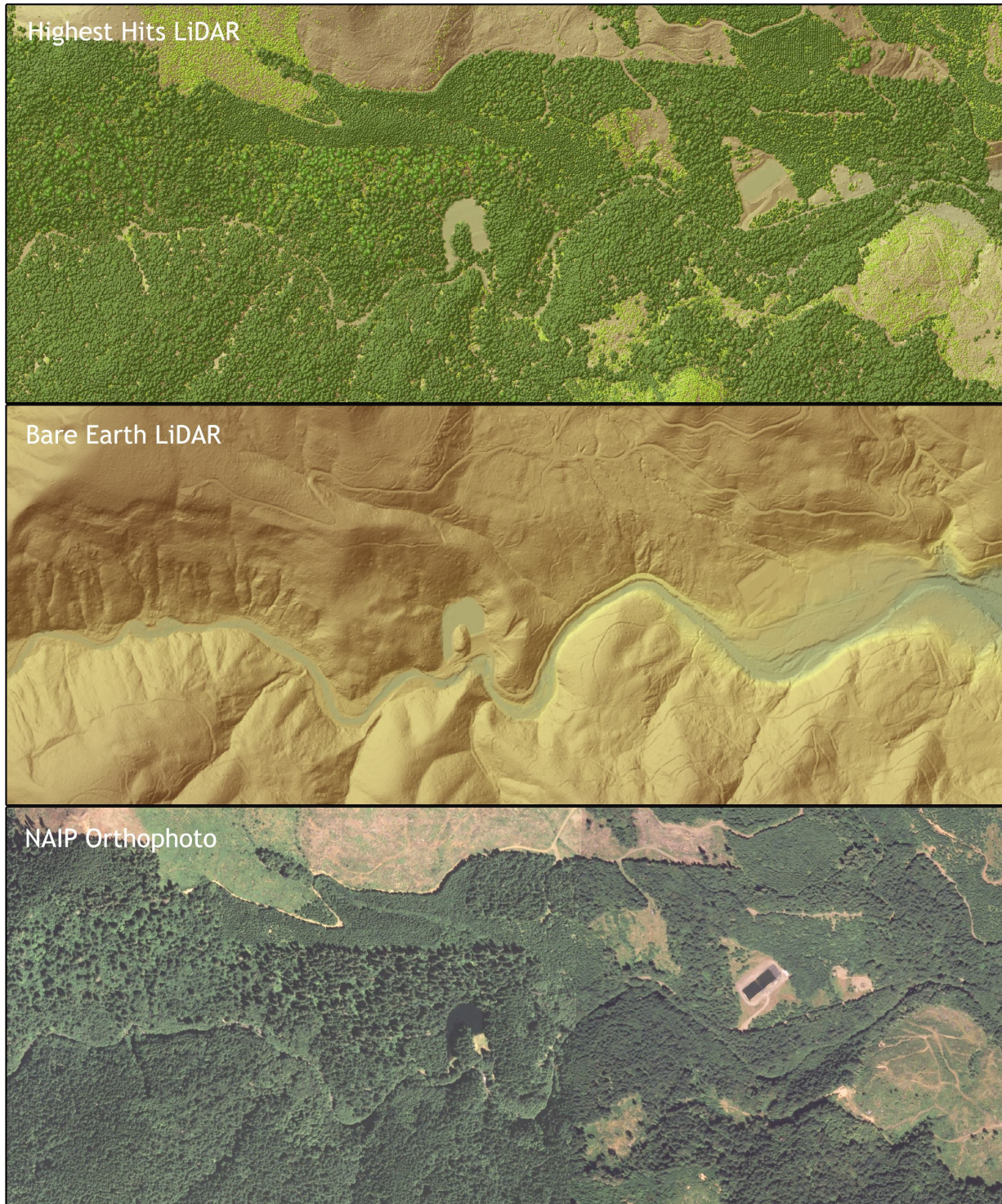


Figure 4.4. Santiam River south of the town of Stayton, Oregon (Quadrangle 44122G7).

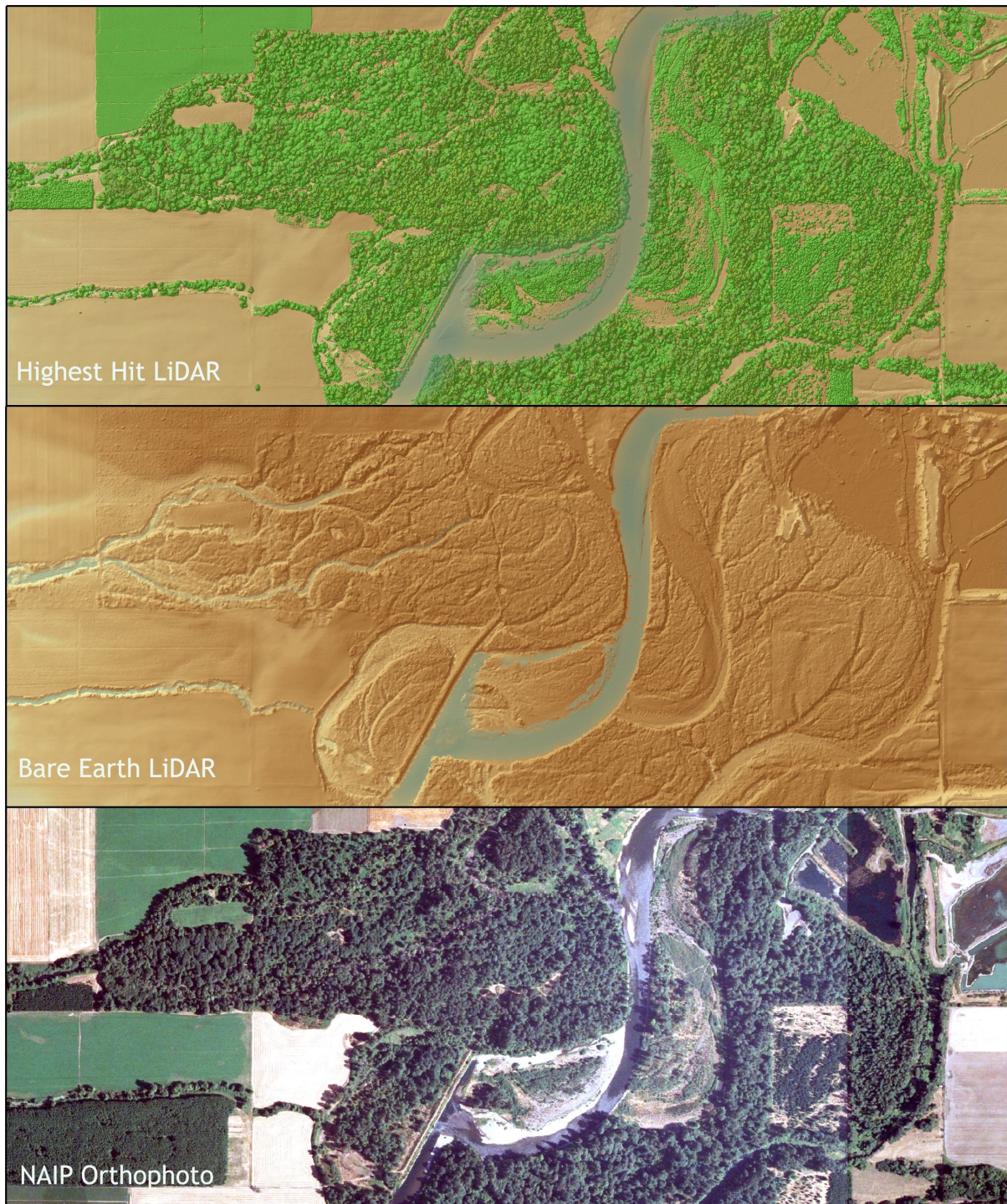


Figure 4.5. Stretch of the Willamette River north of Salem, Oregon (Quadrangle 45123A1).

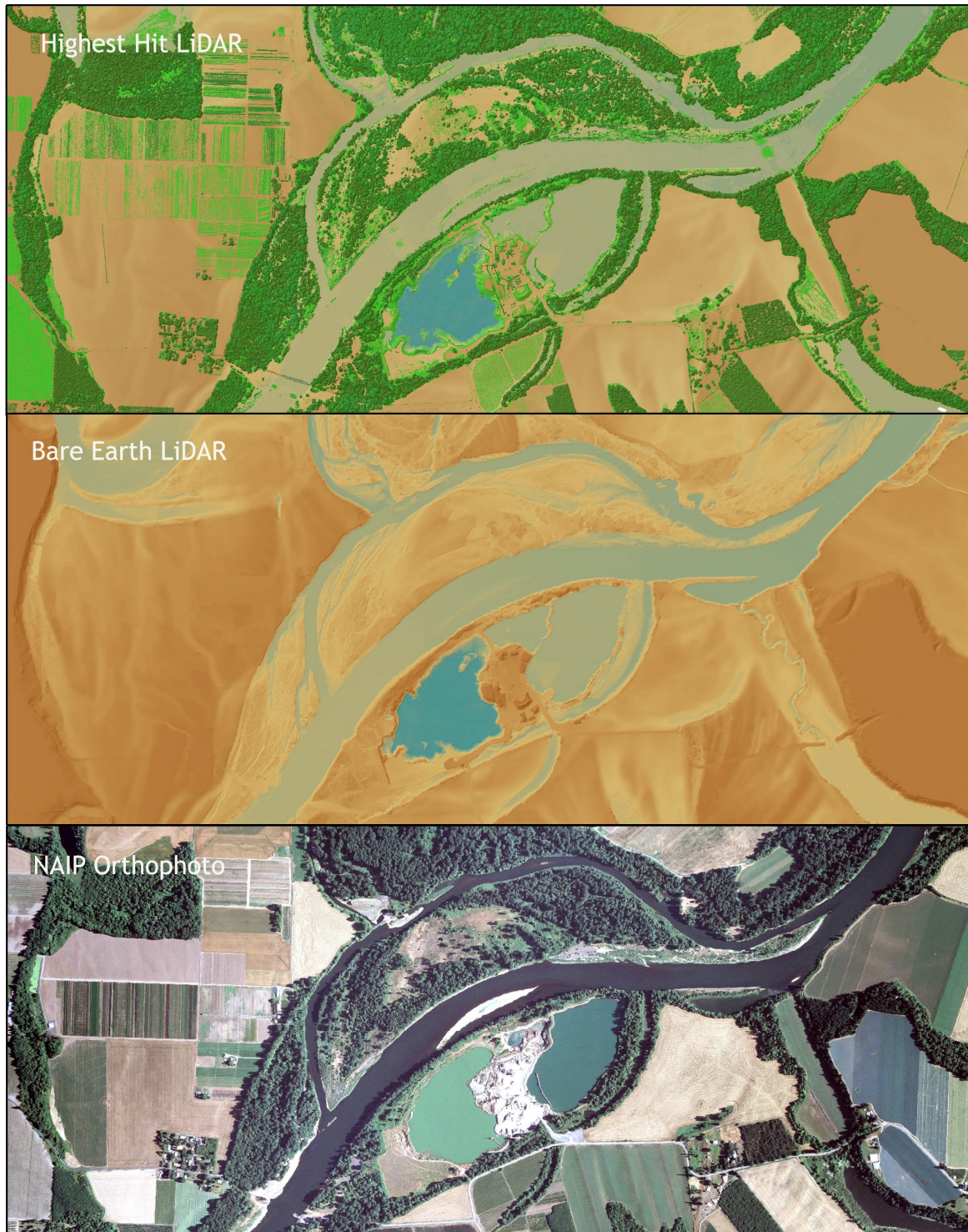


Figure 4.6. Diversion dam on the Santiam River in the town of Lebanon, Oregon (Quadrangle 44122E8).

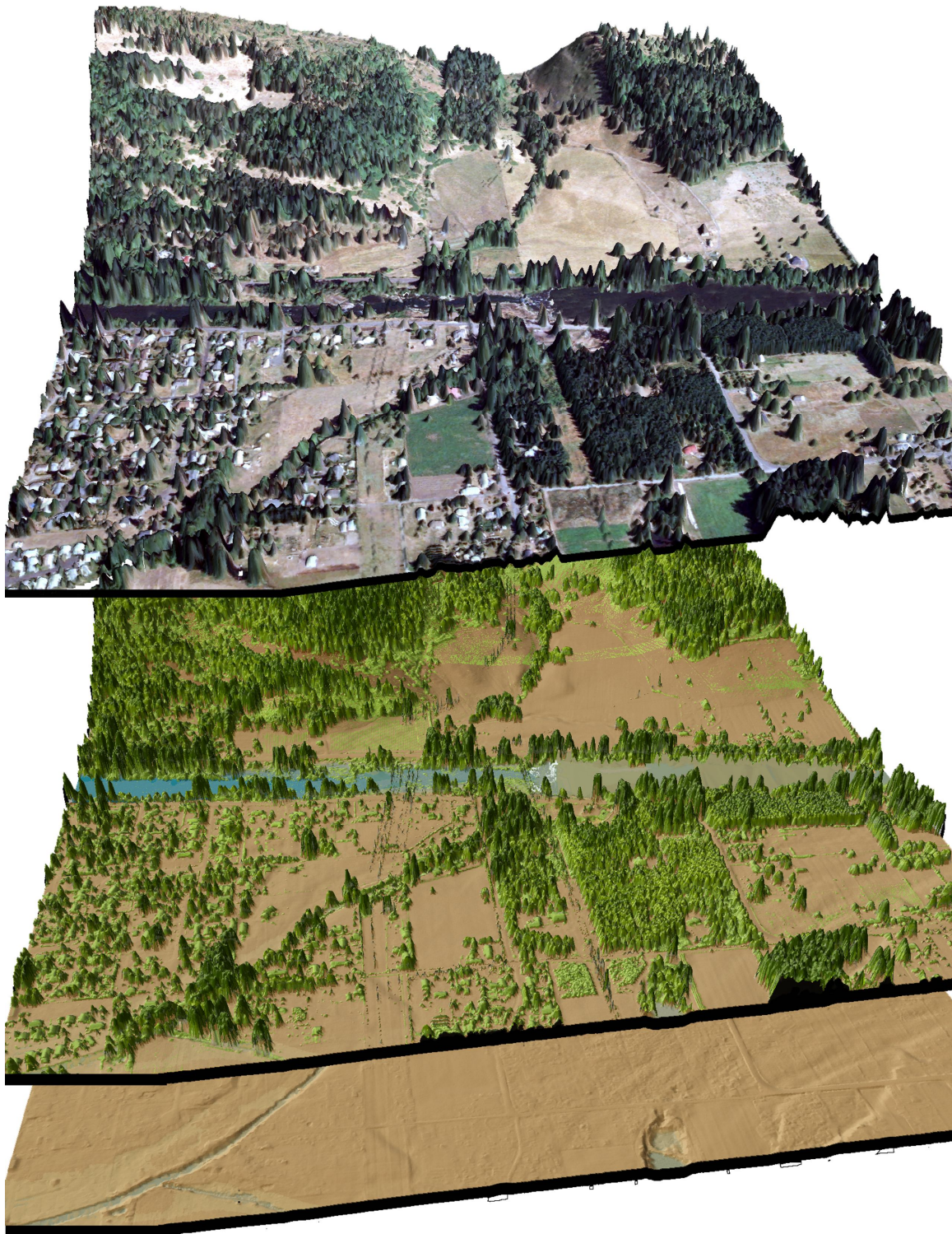


Figure 4.7. Highway 20 bridge over Willamette River in Albany, Oregon (Quadrangle 44123F1).

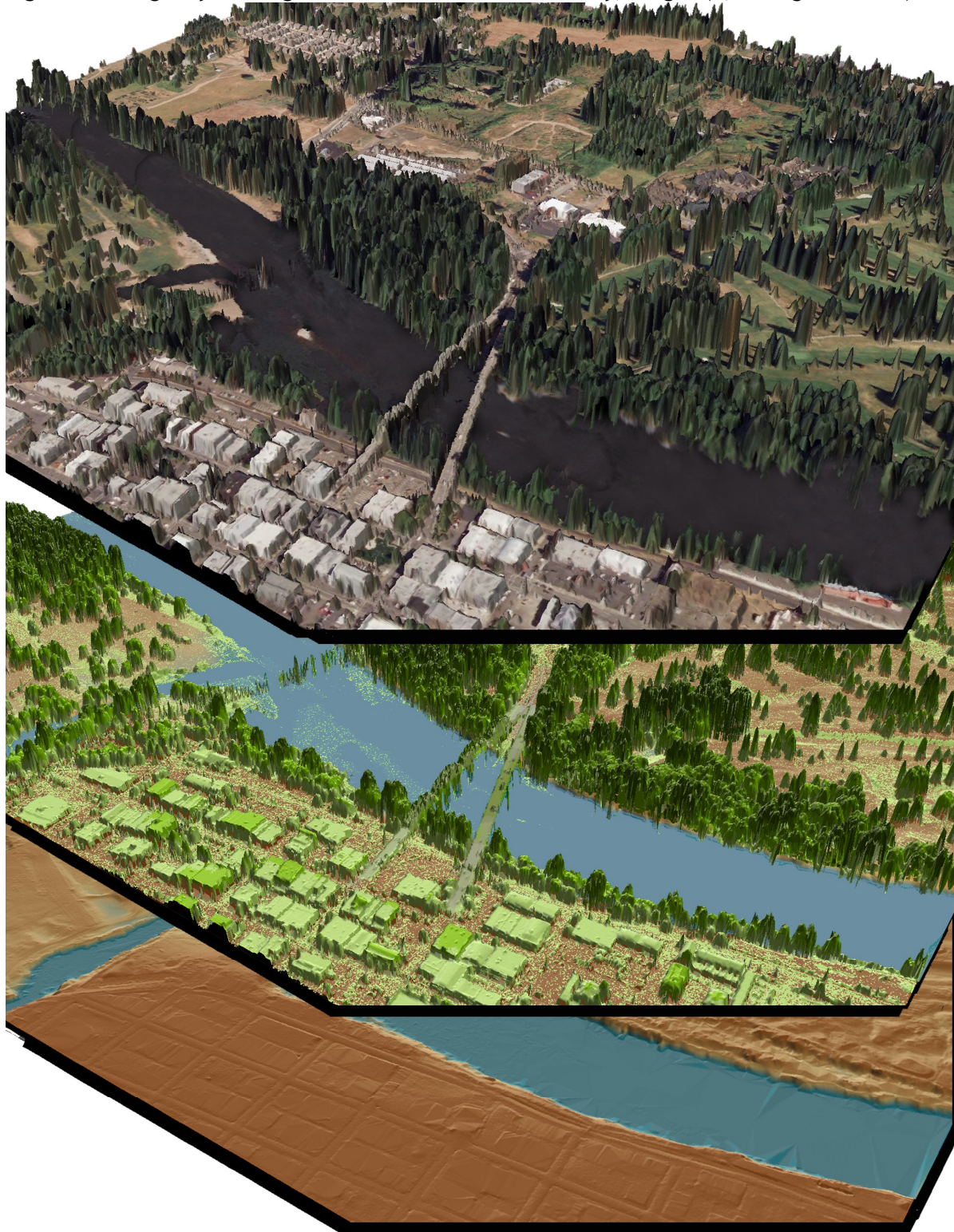


Figure 4.8. Aaron Mercer Reservoir located west of Salem, Oregon(Quadrangle 44123H4).

