Groundwater Protection Program

2015 Monitoring Activity & Results

Sampling Details

The Agricultural Chemicals & Groundwater Protection Program (ACGPP) conducted a variety of sampling in 2015. Only two dedicated networks were sampled as part of the Long-Term Sampling Plan – Weld County Monitoring Wells and High Plains Monitoring Wells. Other sampling work used to fill the schedule included a sampling of public supply wells (PSWs) in Springfield, CO and a method study evaluation comparing results of samples collected with a no-purge HydraSleeve™ sampling device to samples collected with one of the current normal sampling protocols: pneumatic bladder pump (SOP GPP-2) or a peristaltic pump (SOP GPP-1). The method study was conducted on ten of the 21 monitoring wells in the Weld County Long-Term network in August and September. It is important to note that the selection of the ten wells was based primarily on the fact that of the 21 wells consistently sampled in the network, these ten contained the greatest number of pesticide detections, the most variety of pesticide types detected, and covered the spectrum of historical nitrate concentrations. While discussion of the differences in analytical results between the HydraSleeve™ and either other method will not be included in this summary, the sample results from the study collected using either SOP GPP-2 or SOP GPP-1 method, are included in the online database and in this summary since they were collected with approved methods. An in-depth report on the findings from the Springfield PSWs is available under the Publications section of the ACGPP's webpage (http://www.colorado.gov/ag/gw), but only a brief discussion will be included in this summary. Similarly, a report on the method study results will be created and posted to the webpage in the near future. **Table 1** summarizes the sampling logistics with respect to sample numbers, sample dates, and analyses conducted.

2015 Sampling Logistics				
Sample Area	**Purpose**	**# Sampling Events**	**Sample Dates**	**Analysis**
City of Springfield	Requested Investigation	9	5/27/2015 - 5/28/2015	Anions, pesticides, ^{15}N & ^{18}O
Weld County MWs	Scheduled Sampling	21	6/11/2015 - 6/23/2015	Anions, pesticides
Weld County MWs	Method Study Sampling	64	8/10/2015 - 9/22/2015	Anions, pesticides, Pharm. & WWIs
High Plains MWs	Scheduled Sampling	12	10/15/2015 - 10/28/2015	Anions, pesticides

Table 1. Sampling logistics for Ag Chemicals & Groundwater Protection Program's 2015 sampling season. **MWs** is monitoring wells. **Pharm** is pharmaceuticals. **WWIs** is waste water indicators.

The ACGPP has conducted multiple sampling events on all, or a selection of, Weld County MWs every year since 2012 for various reasons. In 2012, four sampling events were conducted on ten MWs to evaluate the variability in measured constituents throughout the season. In 2013 and 2014, the ACGPP conducted three sampling events on all Weld County MWs to primarily analyze for the stable isotopes nitrogen-15 (^{15}N) and oxygen-18 (^{18}O) for work aimed at determining the sources of nitrate contamination in South Platte alluvial

groundwater. Results from the six additional sampling events conducted on ten Weld County MWs in 2015, will be compared to the variability seen in previous years under the *Weld County* sub-title.

The ACGPP's sampling of the municipal public supply wells in the City of Springfield, CO occurred primarily out of a request from the city and a Colorado Rural Water Association representative to investigate the reason behind persistent elevated nitrate concentrations that have kept two of the city's nine wells off-line for the last couple decades. ACGPP personnel collected samples using SOP GPP-3 which can be adapted for sampling of municipal wells. All nine wells were successfully sampled and a brief summary of the data will be discussed under *City of Springfield*.

Samples from High Plains Monitoring Wells were collected using either a HydraSleeve™ or a pneumatic bladder pump (SOP GPP-2). It was known beforehand that the potential for several of the 19 monitoring wells remaining in the network from 2011 might contain insufficient water volume to accomplish sampling because of a water table that has been dropping quickly due to heavy withdrawals. This turned out to be true for seven wells, which the ACGPP will likely schedule to be abandoned and removed from the High Plains sampling network which was only established eight years ago. Of the remaining 12 monitoring wells that were believed to contain adequate water volume for conducting SOP GPP-2, technical difficulties with the equipment resulted in only four of those being effectively sampled. Those four wells were successfully sampled with both a HydraSleeve™ and a pneumatic bladder pump for comparison of the analytical results similar to the method study conducted in Weld County. And while SOP GPP-2 was ineffective on the other eight wells, a HydraSleeve™ sample was collected from the wells to provide opportunity for screening of agricultural chemicals. However, since the HydraSleeve™ has not yet been approved as an acceptable sampling protocol by ACGPP, analytical results from those samples collected with it will not be included in ACGPP's public, online database. Their results will be discussed briefly alongside the results for the four wells sampled with SOP GPP-2 under *High Plains*.

The CDA Biochemistry Lab's 2015 analysis suite for groundwater samples consists of seven anions and 101 pesticide compounds, including glyphosate and its main degradate, AMPA. All samples collected in 2015 were analyzed for these constituents. Split samples collected during the sampling of the City of Springfield PSWs were sent to the Stable Isotope Lab at University of California at Davis for ^{15}N &^{18}O determination as part of the evaluation conducted for the city. A continued partnership between ACGPP and the Center for Environmental Mass Spectrometry at the University of Colorado, saw 100 total samples from the method study in Weld County analyzed for five pharmaceuticals and two waste water indicator compounds. This was to allow for the inclusion of more

Weld County Monitoring Well Nitrate-nitrogen Results						
	All 95-15	**1° 95-15**	**All 12-15**	**1° 12-15**	**All 2015**	**1° 2015**
Average	22.4	22.7	21.3	21.5	20.5	25.2
STD	19.1	19.3	18.3	16.7	18.7	18.1
Minimum	0.01	0.01	0.6	0.6	0.6	0.6
Q1	7.8	9.0	5.6	9.2	3.5	8.9
Median	17.4	18.9	16.3	18.4	14.9	23.0
Q3	30.6	30.2	31.8	29.3	35.5	43.7
Maximum	111.3	111.3	103.0	64.4	64.7	56.3
N	592	416	262	86	85	21

Table 2. Nitrate-nitrogen statistics for samples collected from Weld County monitoring wells between 1995 and 2015. **1'** indicates results for samples collected during the primary scheduled sampling events; **STD** is standard deviation; **Q1, Q3** are the 1st and 3rd quartiles of the dataset; **N** is the number of samples collected; Concentrations units are mg L^{-1}.

constituents into the method study to aid in more comparability between sampling methods. The seven selected compounds have a very high likelihood of occurrence in alluvial groundwater of the South Platte Basin. The analytes screened for at the CDA laboratory and their corresponding reporting limits are presented in **Table 5** at the end of this summary.

Weld County

Inorganics

Nitrate-nitrogen (NO_3-N) values discovered in 2015 were mo stly unremarkable. The median concentrations seen of the primary Weld County sampling (conducted in mid-June to mid-July) agree with historical concentrations. The variability in nitrate seen throughout the seven different sampling events in Weld County that spanned from mid-June to mid-October, agrees with the variability seen of multiple sampling events in 2012, 2013, and 2014. Almost 70% of all samples collected from Weld County monitoring wells since 1995 have been at or above the U.S. EPA Maximum Contaminant Level (MCL) for NO_3-N of 10.0 mg L^{-1} or parts-per-million (ppm). Similarly in 2015, 15 of 21 wells measured over the standard. The statistics for all 21 wells sampled during the regularly scheduled sampling event, as well as other historical nitrate results are seen in **Table 2**.

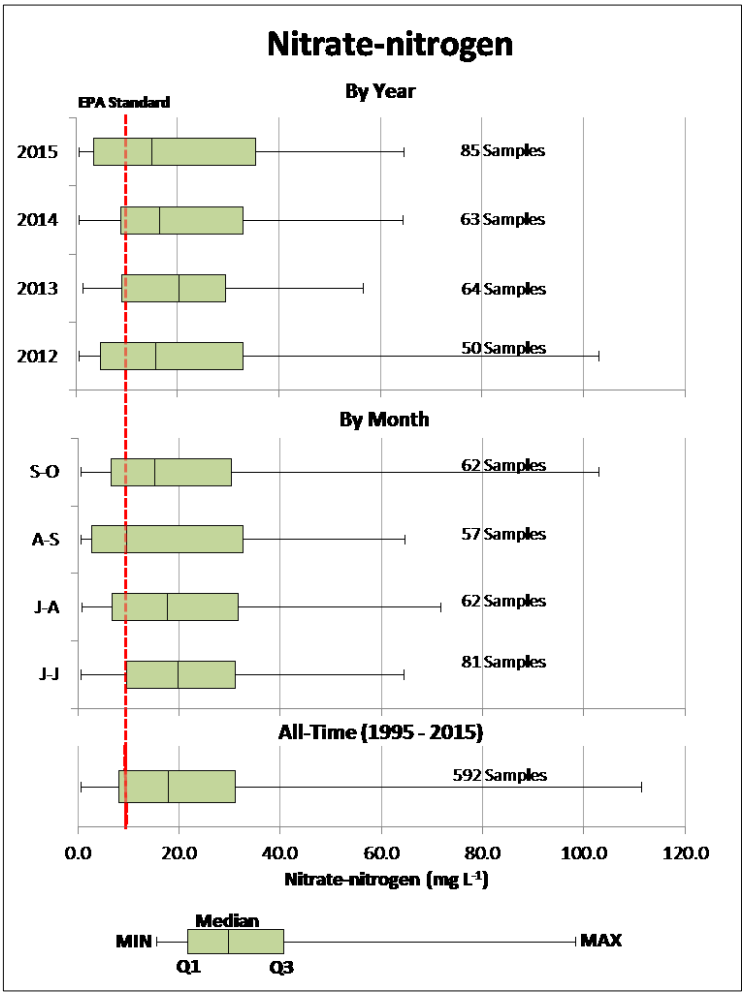

Figure 1 Nitrate results for Weld County monitoring wells sampled in 2012-2015. Box-plots show minimum, 1st quartile (Q1), median, 3rd quartile (Q3), and maximum. S-O, A-S, J-A, and J-J represent September-October, August-September, July-August, and June-July, respectively.

In a shallow alluvial aquifer such as that in the South Platte River Basin, agricultural irrigation is believed to be a significant factor related to nitrate leaching below the root zone and into groundwater. With the multiple sampling events that took place from 2012 to 2015 in the Weld County monitoring well network it was possible to evaluate nitrate concentration variability within the part of the year that sees the heaviest irrigation – June through September. While the sample numbers were not equal between years or between months, there were sufficient sample sizes to analyze for differences. As

can be seen in **Figure 1** there does not appear to be any emerging pattern in the NO_3-N results because of a consistent variability between years or months. Basically, the NO_3-N concentrations seen of samples collected in the June-July timeframe (which realistically runs from mid-June to mid-July) were repeated in later months for the most part. The August-September timeframe saw the lower quartile being less than the other three months; however, the median was still above the EPA standard.

Other measured inorganics from 2012 to 2015, such as sulfate, chloride, bromide, and fluoride, tended to show even less variability between month and year than did NO_3-N. Field measurements such as static water level, electrical conductivity, and dissolved oxygen did not correlate to the changes seen in nitrate concentrations by month or by year. Dissolved oxygen concentrations were fairly consistent over all 262 sampling events from 2012 to 2015 as can be seen in **Figure 2**. The oxic nature of the South Platte alluvial aquifer sampled by this well network, which exists when dissolved oxygen concentration in groundwater is greater than 2.0 mg L^{-1}, does not seem to wane throughout the irrigation season. This makes sense due to the active hydraulic connection between deep percolating irrigation water and seeping irrigation canals. These persistent oxidizing conditions do not allow for appreciable attenuation of nitrate contamination through denitrification.

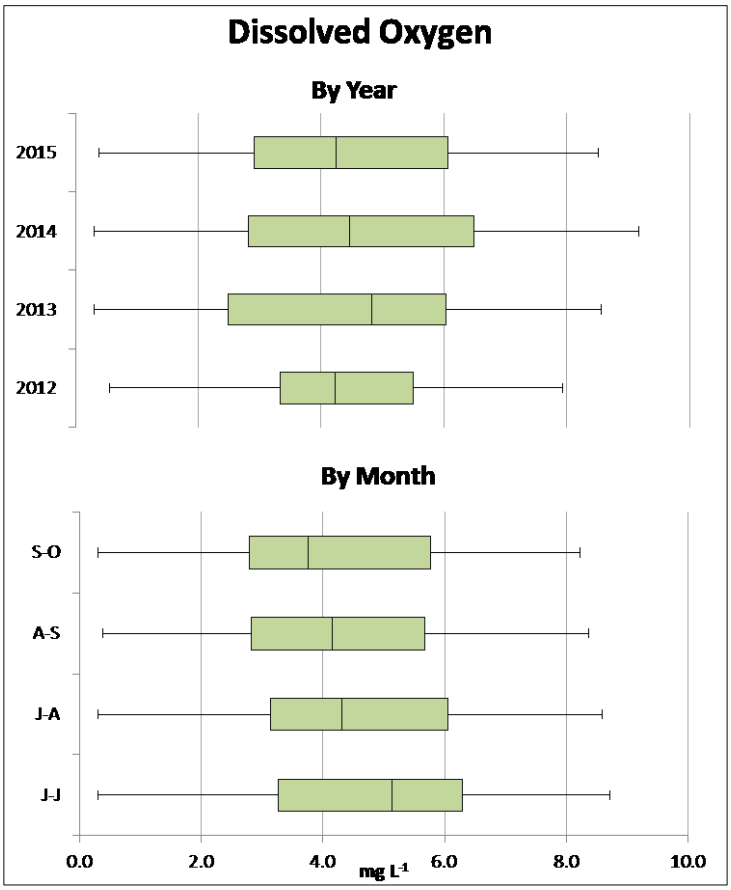

Figure 2 Dissolved oxygen box-plots showing variability by year or by month for samples collected from Weld County monitoring wells over the 2012-2015 time period. S-O, A-S, J-A, and J-J are September-October, August-September, July-August, and June-July, respectively.

The program has also analyzed for dissolved orthophosphate ($O\text{-}PO_4$) over the 2012-2015 sampling seasons. About 60% of all samples collected from 2012-2015 contained $O\text{-}PO_4$ with concentrations ranging from 0.04 to 7.79 mg L^{-1} and 41% of those samples contained less than 1.0 mg L^{-1}. **Figure 3** shows boxplots for 7 of 21 wells with $O\text{-}PO_4$ concentrations consistently above 1.0 mg L^{-1}. WL-M-501 shows the greatest amount of variability over the period 2012-2015. And while the median $O\text{-}PO_4$ concentration of these seven wells does decrease from year to year and from month to month (**Figure 4**), there is no significant difference between any year or month. Since phosphate normally is not leached through soils with more basic pH and ample calcium which results in phosphorus being complexed into precipitates, the fact that such elevated concentrations of the $O\text{-}PO_4$ ion is being discovered in groundwater is both perplexing and concerning. It is

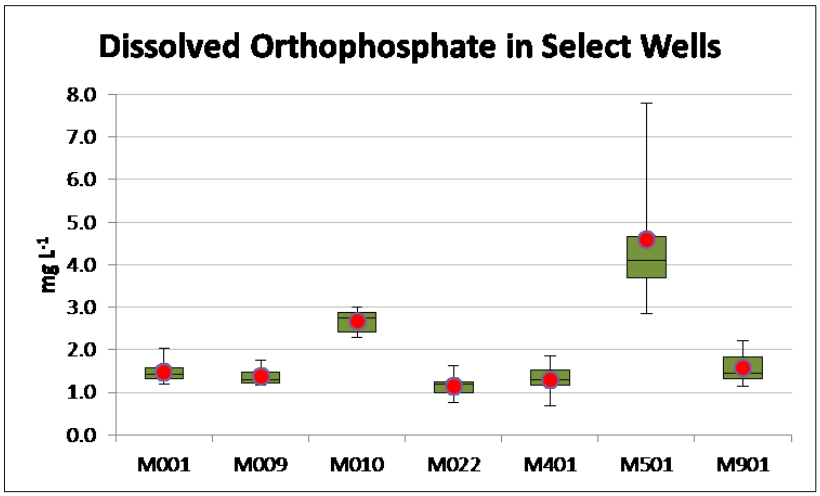

Figure 3 Results for seven Weld County monitoring wells that have tended to measure the highest in dissolved orthophosphate over the 2012-2015 time period. Box-plots show minimum, Q1, median, Q3, and maximum. Red dot indicates average concentration.

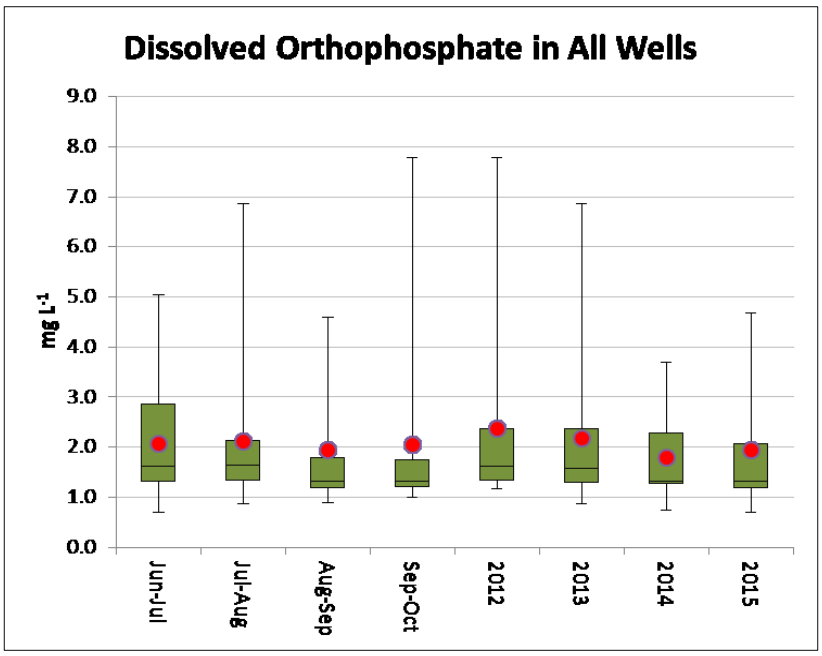

Figure 4 Dissolved orthophosphate results from all Weld County monitoring wells over the 2012-2015 time period. Box-plots show minimum, Q1, median, Q3, and maximum. Red dots indicates average concentration.

important to note that while phosphorus is not known to negatively impact human health and it doesn't have an EPA drinking water standard, groundwater with an elevated phosphorus concentration that discharges to surface water is a concern due to the potential for negative environmental impacts like algal blooms. The ACGPP will be taking a deeper look into the fate and transport of this ion in shallow groundwater systems which will include adjustment of the analysis suite to incorporate other constituents related to phosphorus behavior, such as calcium and iron. For now it is obvious that the factors influencing NO_3 contamination within this part of the South Platte alluvial aquifer are not the same as those influencing $O\text{-}PO_4$ contamination.

Pesticides

All together through 85 sampling events in 2015 – 21 during the primary sampling, and the remainder from five additional rounds of sampling conducted on the ten selected wells for the method study – there were 329 detections of 19 different pesticide compounds. Average concentration amongst those 19 pesticides ranged from 0.06 to 42.02 µg L^{-1}. **Table 3** shows that approximately two-thirds of the detections were less than 1.0 µg L^{-1} and of the 109 detections over 1.0 µg L^{-1}, 88% of those were of metolachlor or its main degradate compounds – metolachlor ethane sulfonic acid (MESA) and metolachlor oxanilic acid (MOA). These results agree with both long-term results (since 1995) and results from the multiple sampling events of 2012-2014.

Weld County Monitoring Well Pesticide Detection Numbers						
Time Period	**1995-2008**	**2009-2015**	**2012-2015 All**	**2012-2015 1'**	**2015 All**	**2015 1'**
All Pesticides	290	1285	881	275	329	67
> 1.0 ppb	12%	30%	36%	33%	33%	34%
< 0.5 ppb	74%	57%	50%	49%	55%	51%
Main 8	251	922	657	209	233	46
> 1.0 ppb	11%	37%	44%	40%	41%	46%
< 0.5 ppb	77%	49%	42%	44%	46%	41%
Metolachlor	54	76	64	17	28	3
> 1.0 ppb	22%	25%	30%	18%	25%	0%
< 0.5 ppb	67%	64%	59%	76%	68%	100%
MESA		317	251	82	84	20
> 1.0 ppb	NA	63%	65%	62%	67%	65%
< 0.5 ppb		23%	24%	28%	24%	30%
MOA		268	216	67	81	17
> 1.0 ppb	NA	44%	46%	42%	41%	47%
< 0.5 ppb		32%	30%	31%	35%	24%
Sample Count	261	331	262	86	85	21

Table 3 Pesticide detection results for Weld County monitoring wells over various time periods. **1'** includes only results from regularly scheduled sampling events. **All** indicates all samples collected over the time period are included in the results. **Main 8** includes atrazine, desethyl atrazine, desisopropyl atrazine, hydroxy atrazine, metolachlor, metolachlor ESA (**MESA**), metolachlor OA (**MOA**), and prometon. MESA and MOA were first analyzed for in 2009.

It is important to remember that the ten wells selected for the method study were selected based on criteria that included the fact that they consistently had a great number of detections of multiple compounds. Therefore, the 2015 results in their entirety are biased high compared to results from other years. With that in mind it was still possible to compare pesticide results between months for the period 2012-2015 because multiple sampling events were conducted in each year. The June-July period is the normal timing for the annual sampling of the Weld County monitoring wells, as has been done since 1995, so results for that period are not biased since each well is sampled only one time during that month in each year.

A total of 275 detections of 28 different pesticide compounds have been discovered in 86 Weld County monitoring well samples collected in June-July from 2012 to 2015. Average concentration amongst the 28 detected compounds ranges from 0.096 to 13.87 $\mu g\ L^{-1}$. Exactly like was explained above regarding results from all samples collected in 2015, only one-third of the detections were at a concentration greater than 1.0 $\mu g\ L^{-1}$. Also similar to earlier, metolachlor-based compounds accounted for 90% of those detections with a concentration greater than 1.0 $\mu g\ L^{-1}$. So while the number of detections seen in 2015 are higher than those seen in 2012-2014 because of the influence of method study selection criteria, the pattern seen in the data with regard to concentrations and the pesticide compounds with the greatest number of detections, holds true even amongst samples collected during the primary sampling events in each year.

Since monitoring for these metolachlor degradate compounds began in 2009, they have accounted for about 45% of all detections. MESA itself has accrued the most detections (317) and also has the highest

average (3.04 µg L^{-1}) and highest median (2.1 µg L^{-1}) of pesticide compounds with more than 20 detections over the period 2009-2015, of which there has been 16. So the metolachlor-based pesticide results for 2015 agree with historical results with no indication of a change in the numbers of detections or concentrations. Furthermore, there were 12 different pesticide compounds with greater than ten detections from 2012 to 2015, and 639 of the 881 total detections (72.5%) over that time period were of degradate products, indicating that the overwhelming majority of detections are of compounds that are derived from degradation processes. Results for 2015 show a slightly lower percentage of degradate product detections at 67%.

During sampling of Weld County monitoring wells between 1995 and 2008, a group of five pesticide compounds accrued the highest number of detects as a group - atrazine (Tradename[1] AAtrex) and its degradates desethyl atrazine (DEA), desisopropyl atrazine; metolachlor (Tradename Bicep); and prometon (Tradename Pramitol). In 2009, the ACGPP added in metolachlor ethanesulfonic acid (MESA), metolachlor oxanilic acid (MOA), and hydroxy atrazine (HA) to its analysis screen and all together these eight compounds (Main 8) have accounted for the majority of all detections. Since 2009, the Main 8 has seen 922 detections in Weld County monitoring wells which is about 72% of total detections that have been discovered since then. From all sampling events over the 2012-2015 time period, the Main 8 have accounted for about 75% of total detections. Similar to the decrease seen in detection percentage of degradate products, the 2015 results showed slightly less at about 70%. With such an abundance of pesticide detections, and with concentrations as great as 85 µg L^{-1}, it is fortunate that only one sample (0.38%) has resulted in detection over an established EPA Drinking Water Standard from 2012-2015.

The ACGPP detected two new pesticides in 2014 in Weld County monitoring wells – chlorantraniliprole (Tradename Coragen) and cyromazine (Tradename Larvadex). While cyromazine was not detected in 2015, chlorantraniliprole was detected ten times in four different wells. The maximum concentration of 1.18 µg L^{-1} was seen in WL-M-013 which saw detection of the pesticide in all six sampling events conducted on the well in 2015. Chlorantraniliprole does not have an EPA drinking water standard. Glyphosate (Tradename Roundup) and its main degradate AMPA were analyzed for the 2nd year as part of ACGPP's groundwater analysis suite, but there was no detection of either compound. A comprehensive listing of all detections discovered in Weld County monitoring wells in 2015 can be seen on the ACGPP's online database: http://erams.com/co_groundwater.

City of Springfield

The results seen of the municipal wells in Springfield in 2015 were very similar to those seen when the ACGPP last sampled those same wells as part of a reconnaissance survey conducted on the High Plains in 1997. However, the NO_3-N concentrations seen in 2015 had decreased in several wells compared to the 1997 measurements except for well #8, which saw an increase in nitrate from 25.0 mg L^{-1} up to 39.2 mg L^{-1} over that time period. The resounding discovery is that well #8 continues to be significantly higher in chloride, bromide, nitrate, sulfate and subsequently electrical conductivity, than any of the other eight

[1] **Tradenames** are used as example for a product that contains a particular active ingredient or pesticide compound and do not indicate that the specific product has been studied and/or detected by the Program.

municipal wells, just as it was in 1997. Furthermore, of the 17 total detections of nine different pesticide compounds, eight of the detections were discovered in well #8. Compared to the next greatest number of detections (three in well #9), this indicates that well #8 is being negatively impacted to a degree that is not seen in other municipal wells in the area.

Stable isotope analysis was not useful in providing a clear picture on the source of the nitrate contamination impacting any of the municipal wells. While some characteristics of the isotope data suggest that there might be some correlation to the distance and direction of a well from one of a couple potential sources, no clear claim to that end can be made. What is evidenced by the data is that the inorganic contamination seen in well #8 is from a different source(s) than the pesticide contamination. The ACGPP recommended to the City of Springfield to abandon the use of well #8 for municipal purposes while retaining it for other uses. Furthermore it was recommended that the city determine if it is in their best interest to conduct further analytical testing of stormwater runoff, drainage channel sediment, and/or groundwater age-dating, in an attempt to hone in on the source(s) of contamination impacting well #8 and others. The complete response to City of Springfield can be found under the publications link on ACGPP's webpage (www.colorado.gov/ag/gw).

High Plains

Even though the municipal wells in Springfield, CO are technically in the High Plains, the monitoring wells installed by ACGPP in 2008 to monitor groundwater quality of the Ogallala Formation from near Holyoke, CO in the north to south of Burlington, CO, are analyzed separately from them. As mentioned earlier, there were only four samples collected using the approved SOP GPP-2 method due to decreased water levels and technical difficulties with equipment. There was however eight wells sampled with a HydraSleeve™ and the nitrate-nitrogen (NO_3-N) for those samples can be compared to other samples collected in 2015 and in prior years.

Out of the 12 sampled wells there was an average increase of 1.50 mg L^{-1} since the last sampling event in 2011. Only four wells had a decrease in NO_3-N but those decreases are all less than 1 mg L^{-1} and two of them were in HydraSleeve™ samples and two in bladder pump samples. Of the four samples collected with the SOP GPP-2 method, none of them were over the EPA drinking water standard for NO_3-N with WL-M-010 being the closest at 9.8 mg L^{-1}. The greatest increase was in HP-M-018 which went from 9.7 mg L^{-1} up to 18.3 mg L^{-1}. That is a near doubling of concentration which is similar to what was seen in WL-M-010 except at a lower magnitude – 4.4 to 9.8 mg L^{-1}. Both of these wells have seen increases in NO_3-N over 9 mg L^{-1} since 2008.

Of the four wells sampled in the High Plains using a bladder pump, only one had a single detection of desethyl-atrazine at 0.12 µg L^{-1}. And while the HydraSleeve™ results will not be included in ACGPP's online database, a sample collected from HP-M-018 with the HydraSleeve resulted in the detection of six pesticides: alachlor ethane sulfonic acid, atrazine, desethyl atrazine, hydroxy atrazine (HA), metolachlor ESA, and metolachlor OA. This result compares well to the result from 2011 for this well where all of the same pesticide compounds were detected except hydroxy atrazine. And even then it is worth noting that

the detected concentration of HA in 2015 was only 0.05 µg L^{-1} which is lower than the 2011 reporting limit for HA at 0.2 µg L^{-1}.

The biggest concern for the High Plains monitoring network is that the water table of the Ogallala Formation is dropping at a rate that will likely result in the ACGPP only being able to sample four of the original twenty wells by 2023. With sampling events only scheduled to occur once every four-five years that means that of the remaining 12 wells sampled in 2015, only six will likely be sampled in 2019, and only four in 2023. Since the ACGPP's prerogative is to sample groundwater near the top of the water table, there is always concern that wells will be lost to sampling due to low water volume in areas of the state that are under the heaviest stress of groundwater withdrawals.

Conclusion

The 2015 sampling season included the normal sampling of Weld County monitoring wells, an investigative sampling of public supply wells for the City of Springfield, and a sampling of the High Plain monitoring well network. In addition to those sampling events, the ACGPP conducted method study on ten wells from the Weld County monitoring well network to evaluate the potential for accepting a HydraSleeve™ no-purge sampling device as an approved method. While the results of the study were not discussed in this report all the samples collected with currently approved methods as part of the method study were included in the comparison of 2015 results to all-time results (since 1995) and to 2012-2014 time period during which multiple sampling events were conducted within the irrigation season.

While the nitrate results seen in 2015, or over the 2012-2015 period, are mostly unremarkable it is important to note that persistent nitrate concentrations begs the question of whether or not nitrate concentrations decrease during baseflow conditions in the South Platte alluvial aquifer. Also of concern is a consistence in detection of relatively high dissolved orthophosphate concentrations in several wells since 2012. It is not understood why this form of phosphorus is finding its way into the shallow aquifer, but fortunately there is no human or animal health risks associated with phosphorus. Pesticide results from Weld County have been fairly consistent from 2012-2015. While on a few occasions there have been detection of high concentrations of some pesticides, the majority of detections tend to be less than 1 µg L^{-1} and also tend to be of the metolachlor-based pesticide compounds. As a matter fact metolachlor-based pesticide detections have accounted for 60% of all detections discovered in Weld County monitoring wells since 2012.

The City of Springfield was provided a thorough report of the findings which for the most part concluded that well #8 is under significantly more impact of agricultural chemicals than are any of the other eight wells owned and operated by the city. Stable isotope analysis did not assist ACGPP in determining if the nitrate in the wells was of organic or inorganic origin, but those results along with the detection of several pesticides in well #8 suggests that there are multiple sources contributing to the contaminant load. It was recommended that the city abandon the public supply 'use' for well #8 and maybe utilize it for other purposes until they can decide whether further investigation into the contaminant(s) source(s) is financially feasible.

Results from the High Plain monitoring well network were few in 2015 due to dropping water levels drying up wells and equipment malfunctions preventing sampling of what wells remained. The nitrate results seen in the 12 wells which included samples from the bladder pump and the HydraSleeve™ were comparable to previous sampling events in 2008 and 2011. There were a couple wells with a doubling of nitrate concentration since 2011. Of the four wells sampled with the bladder pump, only one had a single detection of desethyl atrazine. Another well sampled with the HydraSleeve™ detected six pesticide compounds which agreed well with 2011 results for the same well that saw five of the same pesticides detected. While the main method study conducted in Weld County will determine the suitability of this sampling device, this result bodes well towards ACGPP's desire to use the HydraSleeve™ for its normal baseline sampling responsibilities.

All of the data seen and/or discussed in this monitoring summary, with the exception of any data arising from samples collected with the HydraSleeve™ sampling device, can be queried and downloaded from the Program's online water quality database and map viewer which can be accessed at: http://www.erams.com/co_groundwater. Program personnel contact information and other information can be found on the Program's main website http://www.co.gov/ag/gw.

Pesticide Compounds Detected in Various Networks Sampled in 2015				
Pesticide Active Ingredient	**Network**	**# Detects**	**Conc. Range (Median)**	**Note**
2,4-D	Weld County MWs	3	0.10 - 0.20 (0.20)	No Drinking Water Standard
Alachlor ESA	Weld County MWs	2	0.11 - 0.13 (0.12)	No Drinking Water Standard
Atrazine	Springfield PSWs	1	0.1	U.S. EPA Drinking Water MCL 3.0 µg L^{-1}
Bromacil	Springfield PSWs	2	0.98 - 3.94	U.S. EPA Drinking Water HAL 70 µg L^{-1}
Chlorantraniliprole	Weld County MWs	9	0.10 - 1.18 (0.40)	U.S. EPA HHBP Chronic 11,060 µg L^{-1}
Desethyl Atrazine	Weld County MWs	11	0.10 - 0.16 (0.11)	No Drinking Water Standard
	High Plains MWs	1	0.11	
	Springfield PSWs	4	0.14 - 0.21 (0.19)	
Deisopropyl Atrazine	Weld County MWs	3	0.10 - 0.27 (0.11)	No Drinking Water Standard
	Springfield PSWs	3	0.10 - 0.16 (0.11)	
Dicamba	Weld County MWs	4	0.25 - 0.38 (0.32)	U.S. EPA HAL 4000 µg L^{-1}
Diflufenzopyr	Weld County MWs	5	0.41 - 85.50 (35.40)	U.S. EPA HHBP Chronic 1,082 µg L^{-1}
Dimethenamid ESA	Weld County MWs	10	0.11 - 0.74 (0.58)	No Drinking Water Standard
Dimethenamid OA	Weld County MWs	7	0.16 - 0.31 (0.25)	No Drinking Water Standard
Dimethoate	Weld County MWs	5	0.28 - 15.50 (14.50)	U.S. EPA HHBP Chronic 15 µg L^{-1}
Diuron	Springfield PSWs	1	0.16	No Drinking Water Standard
Hydroxy Atrazine	Weld County MWs	26	0.04 - 0.10 (0.06)	U.S. EPA HHBP Chronic 70 µg L^{-1}
Imazapyr	Weld County MWs	27	0.10 - 9.49 (0.12)	U.S. EPA HHBP Chronic 17,500 µg L^{-1}
	Springfield PSWs	1	0.97	
Imidocloprid	Weld County MWs	5	0.15 - 0.41 (0.40)	U.S. EPA HHBP Chronic 339 µg L^{-1}
Malathion	Weld County MWs	1	0.27	U.S. EPA HAL 500 µg L^{-1}
Metolachlor	Weld County MWs	28	0.10 - 18.40 (0.36)	U.S. EPA Drinking Water HAL 700 µg L^{-1}
Metolachlor ESA	Weld County MWs	84	0.12 - 11.80 (2.84)	No Drinking Water Standard
Metolachlor OA	Weld County MWs	81	0.10 - 7.18 (0.81)	No Drinking Water Standard
Norflurazon	Springfield PSWs	1	0.38	U.S. EPA HHBP Chronic 105 µg L-1
Picloram	Weld County MWs	1	0.78	U.S. EPA Drinking Water MCL 500 µg L^{-1}
	Springfield PSWs	3	0.15 - 2.60 (0.19)	
Tebuthiuron	Springfield PSWs	1	0.27	
Thiamethoxam	Weld County MWs	17	0.12 - 3.33 (0.26)	U.S. EPA HHBP Chronic 84 µg L^{-1}

Conc. Range (Median) is the range of concentration the detected pesticide active ingredient was discovered at, and for instances with three or more detections the median is shown in parentheses; **HAL** is Health Advisory Level; **MCL** is Maximum Contaminant Level; **HHBP** is Human Health Benchmark for Pesticides used primarily for decision making and is not an enforceable standard; **MWs** is monitoring wells; **PSWs** is public supply wells; Concentrations are in µg L^{-1}. Only data derived from samples collected with ACCGP approved methods is included in this table.

Table 4 Listing of all pesticide detections from samples collected in 2015 using approved sampling methods.

Analytes Measured of Groundwater Samples at Colorado Department of Agriculture's Biochemistry Lab in 2015							
Analyte Name	**Reporting Limit**	**Units**	**Laboratory**	**Analyte Name**	**Reporting Limit**	**Units**	**Laboratory**
2,4-D	0.1	ug/L	CDA Groundwater Lab	Imazamox	0.1	ug/L	CDA Groundwater Lab
2,4-DB	0.1	ug/L	CDA Groundwater Lab	Imazapic	0.1	ug/L	CDA Groundwater Lab
2,4-DP	0.1	ug/L	CDA Groundwater Lab	Imazapyr	0.1	ug/L	CDA Groundwater Lab
3-Hydroxycarbofuran	0.1	ug/L	CDA Groundwater Lab	Imazethapyr	0.1	ug/L	CDA Groundwater Lab
Acetochlor	0.1	ug/L	CDA Groundwater Lab	Imidacloprid	0.1	ug/L	CDA Groundwater Lab
Acetochlor ESA	0.1	ug/L	CDA Groundwater Lab	Isoxaflutole	0.1	ug/L	CDA Groundwater Lab
Acetochlor OA	0.1	ug/L	CDA Groundwater Lab	Kresoxim methyl	0.1	ug/L	CDA Groundwater Lab
Acifluorfen	0.1	ug/L	CDA Groundwater Lab	Linuron	0.5	ug/L	CDA Groundwater Lab
Alachlor	0.1	ug/L	CDA Groundwater Lab	Malathion	0.1	ug/L	CDA Groundwater Lab
Alachlor ESA	0.1	ug/L	CDA Groundwater Lab	MCPA	0.1	ug/L	CDA Groundwater Lab
Alachlor OA	0.1	ug/L	CDA Groundwater Lab	MCPP	0.1	ug/L	CDA Groundwater Lab
Aldicarb	0.1	ug/L	CDA Groundwater Lab	Metalaxyl	0.1	ug/L	CDA Groundwater Lab
Aldicarb sulfone	0.2	ug/L	CDA Groundwater Lab	Metconazole	0.1	ug/L	CDA Groundwater Lab
Aldicarb sulfoxide	0.1	ug/L	CDA Groundwater Lab	Methomyl	0.1	ug/L	CDA Groundwater Lab
Aminopyralid	0.2	ug/L	CDA Groundwater Lab	Metolachlor	0.1	ug/L	CDA Groundwater Lab
AMPA	2.0	ug/L	CDA Groundwater Lab	Metolachlor ESA	0.1	ug/L	CDA Groundwater Lab
Atrazine	0.1	ug/L	CDA Groundwater Lab	Metolachlor OA	0.1	ug/L	CDA Groundwater Lab
Azoxystrobin	0.1	ug/L	CDA Groundwater Lab	Metribuzin	0.1	ug/L	CDA Groundwater Lab
Bentazon	0.25	ug/L	CDA Groundwater Lab	Metsulfuron methyl	0.1	ug/L	CDA Groundwater Lab
Bromacil	0.2	ug/L	CDA Groundwater Lab	Nicosulfuron	0.1	ug/L	CDA Groundwater Lab
Carbaryl	0.2	ug/L	CDA Groundwater Lab	Norflurazon	0.2	ug/L	CDA Groundwater Lab
Carbofuran	0.1	ug/L	CDA Groundwater Lab	Norflurazon desmethyl	0.5	ug/L	CDA Groundwater Lab
Chlorantraniliprole	0.1	ug/L	CDA Groundwater Lab	Oxamyl	0.2	ug/L	CDA Groundwater Lab
Chlorimuron ethyl	0.1	ug/L	CDA Groundwater Lab	Oxydemeton methyl	0.1	ug/L	CDA Groundwater Lab
Chlorsulfuron	0.1	ug/L	CDA Groundwater Lab	Picloram	0.5	ug/L	CDA Groundwater Lab
Clopyralid	0.25	ug/L	CDA Groundwater Lab	Prometon	0.1	ug/L	CDA Groundwater Lab
Cyanazine	0.1	ug/L	CDA Groundwater Lab	Propazine	0.1	ug/L	CDA Groundwater Lab
Cyproconazole	0.1	ug/L	CDA Groundwater Lab	Propoxur	0.1	ug/L	CDA Groundwater Lab
Cyromazine	0.1	ug/L	CDA Groundwater Lab	Prosulfuron	0.1	ug/L	CDA Groundwater Lab
Desethyl Atrazine	0.1	ug/L	CDA Groundwater Lab	Pyrimethanil	0.1	ug/L	CDA Groundwater Lab
Desisopropyl Atrazine	0.1	ug/L	CDA Groundwater Lab	Quinclorac	0.1	ug/L	CDA Groundwater Lab
Dicamba	0.25	ug/L	CDA Groundwater Lab	Simazine	0.1	ug/L	CDA Groundwater Lab
Diflufenzopyr	0.25	ug/L	CDA Groundwater Lab	Sulfentrazone	0.2	ug/L	CDA Groundwater Lab
Dimethenamid	0.25	ug/L	CDA Groundwater Lab	Sulfometuron methyl	0.1	ug/L	CDA Groundwater Lab
Dimethenamid ESA	0.1	ug/L	CDA Groundwater Lab	Sulfosulfuron	0.1	ug/L	CDA Groundwater Lab
Dimethenamid OA	0.1	ug/L	CDA Groundwater Lab	Tebuconazole	0.1	ug/L	CDA Groundwater Lab
Dimethoate	0.1	ug/L	CDA Groundwater Lab	Tebufenozide	0.1	ug/L	CDA Groundwater Lab
Dinotefuran	0.1	ug/L	CDA Groundwater Lab	Tebuthiuron	0.1	ug/L	CDA Groundwater Lab
Disulfoton sulfone	0.1	ug/L	CDA Groundwater Lab	Terbacil	0.1	ug/L	CDA Groundwater Lab
Disulfoton sulfoxide	0.1	ug/L	CDA Groundwater Lab	Thiamethoxam	0.1	ug/L	CDA Groundwater Lab
Diuron	0.1	ug/L	CDA Groundwater Lab	Triadimefon	0.1	ug/L	CDA Groundwater Lab
Ethofumesate	0.2	ug/L	CDA Groundwater Lab	Triallate	0.1	ug/L	CDA Groundwater Lab
Ethoprop	0.1	ug/L	CDA Groundwater Lab	Triasulfuron	0.1	ug/L	CDA Groundwater Lab
Fenamiphos	0.1	ug/L	CDA Groundwater Lab	Trichlorfon	0.2	ug/L	CDA Groundwater Lab
Fenamiphos sulfone	0.1	ug/L	CDA Groundwater Lab	Triclopyr	0.5	ug/L	CDA Groundwater Lab
Florasulam	0.1	ug/L	CDA Groundwater Lab	Triticonazole	0.1	ug/L	CDA Groundwater Lab
Flufenacet	0.1	ug/L	CDA Groundwater Lab	Bromide	0.05	mg/L	CDA Groundwater Lab
Flumetsulam	0.1	ug/L	CDA Groundwater Lab	Chloride	0.05	mg/L	CDA Groundwater Lab
Glyphosate	1.0	ug/L	CDA Groundwater Lab	Fluoride	0.05	mg/L	CDA Groundwater Lab
Halofenozide	0.1	ug/L	CDA Groundwater Lab	Nitrate-nitrogen	0.011	mg/L	CDA Groundwater Lab
Halosulfuron methyl	0.1	ug/L	CDA Groundwater Lab	Nitrite-nitrogen	0.015	mg/L	CDA Groundwater Lab
Hydroxy Atrazine	0.1	ug/L	CDA Groundwater Lab	Ortho-phosphate (Dissolved)	0.05	mg/L	CDA Groundwater Lab
Imazamethabenz ester	0.1	ug/L	CDA Groundwater Lab	Sulfate	0.05	mg/L	CDA Groundwater Lab

Table 5 Table of pesticide and anion reporting limits for analysis conducted in 2015

COLORADO
Department of Agriculture
Conservation Services Division