Forest Park Mobile Home Park Wastewater Treatment Facility Groundwater and Surface Water Monitoring Data Report

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Acronyms and Abbreviations

CFU: Colony forming units

DO: Dissolved oxygen

EHS: Environmental Health Services

GLWQD: Gallatin Local Water Quality District

I/P: Infiltration/percolation

mg/L: Milligrams per liter (also equivalent to parts per million in water)

MT DEQ: Montana Department of Environmental Quality

ND: Not detected

SC: Specific conductance

TKN: Total Kjeldahl Nitrogen

TNTC: Too numerous to count

WWTF: Wastewater treatment facility

US EPA: United States Environmental Protection Agency

1.0 EXECUTIVE SUMMARY

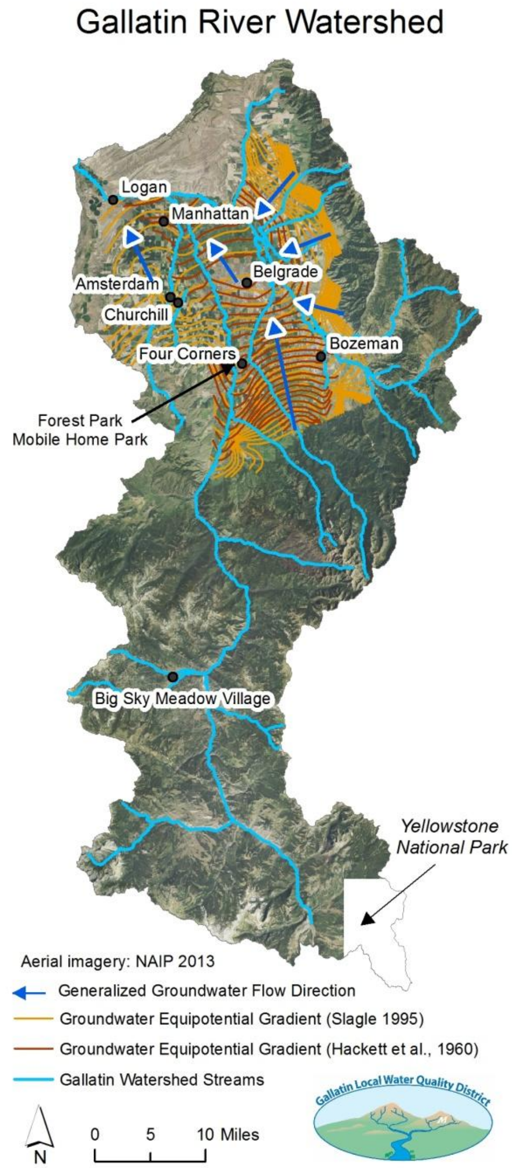

Figure 1. The Gallatin River Watershed shown with streams and potentiometric contours for groundwater in the Gallatin Valley (orange and red lines based upon Slagle 1995, and Hackett et al., 1960, respectively). Groundwater generally moves from the south and east to the northwest (blue arrows), towards the Logan area.

The groundwater and surface water quality near the Forest Park Mobile Home Park wastewater treatment facility was investigated in 2011, 2012, and 2013 following complaints dating back to the 1980s regarding the system and the potential impact on local water resources. Historical data collected in the 1980s in down-gradient monitoring wells and Jay Hawk Creek indicated possible wastewater effects, though a targeted water quality assessment of groundwater and surface water was needed. Additional data collected in 2008 was inconclusive. Montana Department of Environmental Quality, Forest Park Mobile Home Park, and the Gallatin Local Water Quality District cooperated on a project to collect data in order to assess potential impacts from the lagoon system to adjacent water resources. In 2011 and 2012, the two wells down-gradient of the lagoon system were sampled, along with one well up-gradient of the lagoon system that was installed during this project. In addition, Jay Hawk Creek was monitored for field parameters, and in 2013, additional samples from a nearby seep and from a drain underneath the lagoon liner were collected. Results indicate that there is an impact from wastewater to the shallow down-gradient groundwater based on elevated total ammonia-N levels, and higher levels of specific conductivity, chloride and boron relative to the up-gradient groundwater data. Dissolved oxygen results reveal low-oxygen conditions in the aquifer down-gradient of the lagoon system where elevated total ammonia-N levels were found; indicating that nitrification of the effluent is not occurring, or only occurring to a minimal extent. This may be a result of the lack of effluent dispersion across the infiltration/percolation cells before effluent is discharged to groundwater. Furthermore, field parameter data (pH, specific conductance, dissolved oxygen, and temperature) indicate wastewater and groundwater influence on nearby Jay Hawk Creek. An increase in temperature along the reach is likely a result of groundwater entering the stream. Additionally, an increase in specific conductance along the monitored stream reach adjacent to the wastewater treatment facility is likely a result of wastewater influence on groundwater, and subsequent groundwater migration into the stream. Decreased dissolved oxygen and pH levels in the stream as it passes near the edge of the infiltration/percolation cells may also be related to the wastewater influence on groundwater and surface water. Effects on the nearby West Gallatin River are expected to be minimal or not-detectable, due to the relative volume of water in the river compared to that of Jay Hawk Creek.

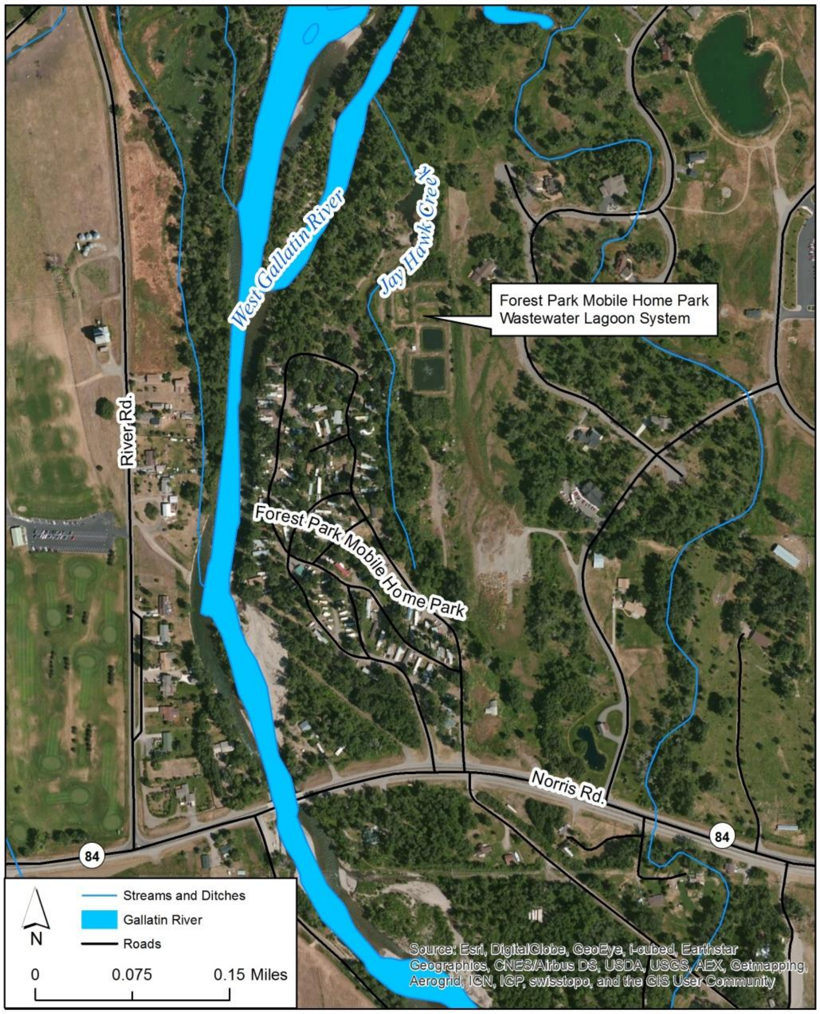

Figure 2. The location of the Forest Park Mobile Home Park wastewater treatment facility near Four Corners, Montana.

2.0 BACKGROUND AND INTRODUCTION

Gallatin County has 13 public sewage lagoon systems, collectively discharging an estimated 1.8 million gallons per day of effluent mostly into groundwater (English 2010). Several of these systems currently have or have had problems, including the Forest Park Mobile Home Park wastewater treatment facility (WWTF) in Gallatin Valley near Four Corners, Montana, along the east bank of the West Gallatin River. The system first treats wastewater using an aeration pond, then a settling basin, and finally to one of three infiltration/percolation (I/P) beds where effluent should disperse before infiltrating and percolating to groundwater. Only one of the three I/P beds is used at a time (**Figure 3**). For two, two-hour periods each day, a pump is run to recirculate wastewater from the bottom of the settling basin back to the aeration pond inlet. The system was built prior to groundwater discharge permit requirements. Concerns as to whether the Forest Park wastewater treatment facility negatively affects water quality in nearby alluvial groundwater and adjacent waterways date back to the 1980s. Following a complaint in 2008, a field investigation was conducted, including collection of two stream samples by the Montana Department of Environmental Quality (MT DEQ). An October 2011 inspection by MT DEQ noted that there is evidence of elevated nutrients in the area near the WWTF as evidenced by the heavy algal growth in adjacent Jay Hawk Creek. It was described that wastewater entering the I/P cells did not appear to disperse across the cells; rather it appeared to infiltrate into the ground at the location where the pipe drains to the cells. An estimated 26,000 gallons per day are discharged from the lagoon system. The MT DEQ, Forest Park Mobile Home Park, and Gallatin Local Water Quality District (GLWQD) collaborated on a project, beginning in November of 2011, to collect additional data to enhance the understanding of groundwater and surface water conditions near the facility and to assess any effects on these water resources from the lagoon system.

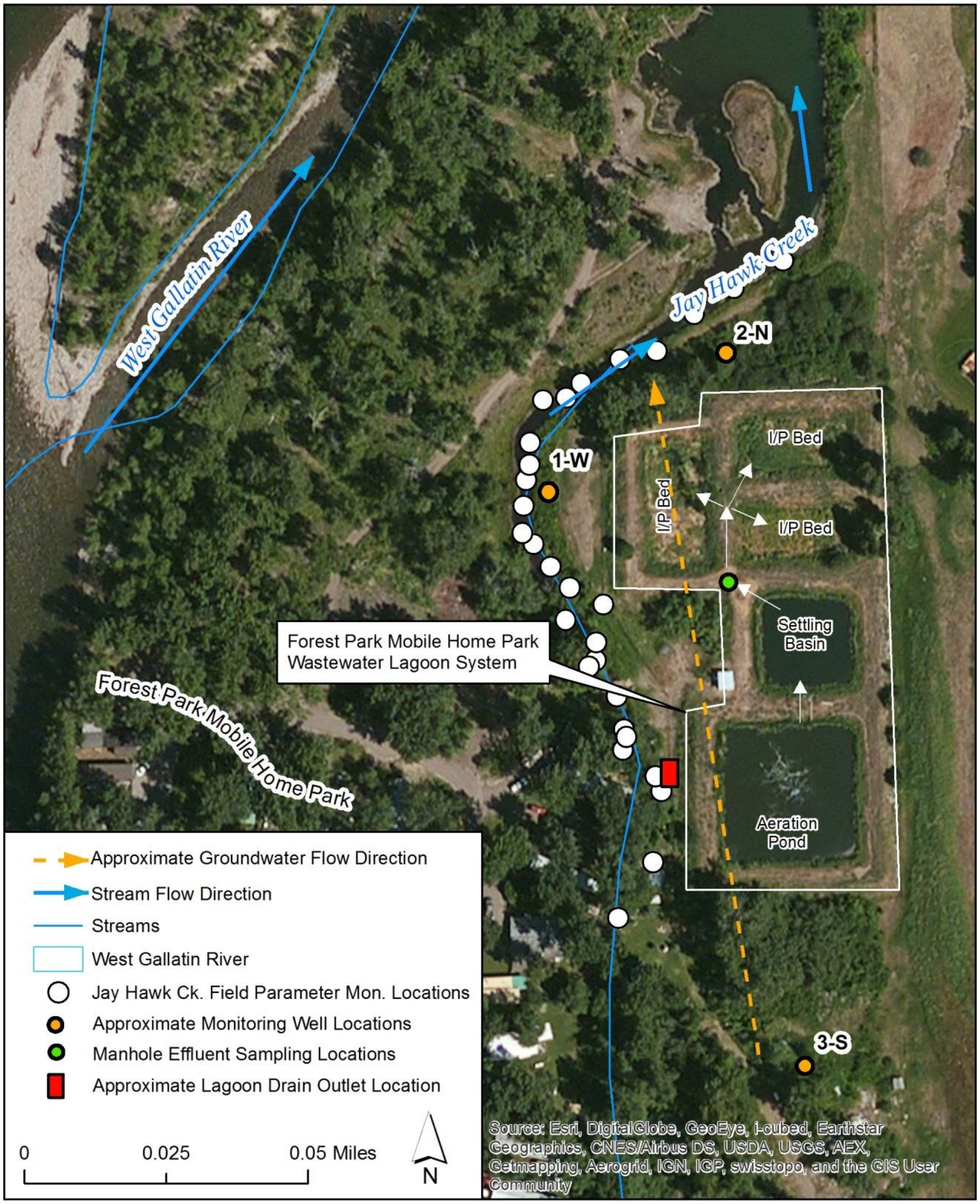

Figure 3. The approximate location of the three monitoring wells near the Forest Park Mobile Home Park wastewater treatment facility. Stream flow as well as groundwater flow is generally from south to north. The Forest Park Mobile Home Park wastewater treatment facility (WWTF) treats wastewater using an aeration pond, a settling basin, and three infiltration/percolation (I/P) beds, only one of which is used at a time. White arrows indicate the direction of wastewater movement within the system. The facility was constructed in the 1970s and the system was expected to have a 20-year life span. 2-N and 1-W are monitoring wells generally considered down-gradient from the WWTF, while 3-S is a monitoring well considered up-gradient from the WWTF.

2.1 Groundwater Monitoring Plan Objective

The objective of this project was to determine if wastewater effluent discharging through the infiltration/percolation (I/P) beds of the Forest Park Mobile Home Park WWTF is contributing to undesirable aquatic life in adjacent surface water or otherwise adversely impacting local groundwater quality. Historical data was minimal and additional data collection was needed to assess whether the wastewater lagoon system was impacting adjacent water resources.

This report fulfills the request from MT DEQ for GLWQD to collect water quality data and provide a data summary report on the results of the sampling from the Forest Park Mobile Home Park WWTF.

2.2 Project Area

The project area is located in the Gallatin Valley within the Gallatin River watershed, part of the Upper Missouri River watershed. Regional groundwater flow in the Gallatin Valley is generally from the south to the northwest (Hackett, et al. 1960; Slagle 1995) (**Figure 1**). Mean annual precipitation ranges from 55 inches in the upper watershed near Big Sky to 12 inches in the western portion near Logan. The study area was the Forest Park Mobile Home Park WWTF, approximately one mile west of the intersection of State Highway 84 and State Highway 191 in the Four Corners area. The Mobile Home Park and WWTF are immediately north of State Highway 84 (Norris Road), and adjacent to the east bank of the West Gallatin River, which flows north (**Figures 2, 3**). Jay Hawk Creek is a spring fed creek that flows north between the West Gallatin River and the Forest Park WWTF in a well developed channel (**Figure 3**). The surficial geology of the Forest Park area is Quaternary alluvium (Vuke, et al. 2014), and soils consist of Bandy-Riverwash-Bonebasin complex (Mollisol, coarse-loamy over sandy or sandy-skeletal) and Sudworth-Nesda loams (Mollisol, fine-loamy over sandy or sandy-skeletal) (Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture 2012).

3.0 METHODS

The GLWQD staff collected samples from three monitoring wells and several additional locations including a seep. Jay Hawk Creek was monitored for field parameters. Effluent was sampled from a manhole between the settling basin and the splitter where it enters one of three I/P cells (**Figure 2**).

Adjacent to the Forest Park WWTF are monitoring wells 1-W and 2-N, to the west and the north, respectively (**Figure 3**). Both are within approximately 200 feet of Jay Hawk Creek, are 18 feet deep, and finished in coarse alluvial material. Well 1-W is screened from 7'-18' while well 2-N is screened from 5'-18'. Available historical data for these monitoring wells and Jay Hawk Creek was compiled. A supplementary monitoring well, 3-S, was installed during the project in November of 2011, up-gradient of the WWTF (**Figure 3**) for comparability. This well extends to approximately 6.4 feet below the ground surface, with a screened interval of approximately 0.9 feet. Additional samples were taken between November 2011 and March 2012 from the three monitoring wells and the wastewater effluent. In 2013, samples were taken from a seep along Jay Hawk Creek and from a pipe draining groundwater from underneath the lagoon into the creek (hereafter called lagoon drain). These samples were analyzed for boron, chloride, total ammonia–N (NH_3 + NH_4^+ as N), Total Kjeldahl N (TKN), nitrate + nitrite-N, orthophosphate-P, and *E. coli* bacteria (for select samples) by Energy Laboratories, Inc. During the time of sampling, field parameters were recorded and photographs were taken. In March of 2012, field parameter data was collected from 29 stations longitudinally within Jay Hawk Creek near the WWTF **(Figure 3)**. At each of these 29 stations, pH, specific conductance (SC), temperature and dissolved oxygen (DO) were recorded. This information was used to assess whether the lagoon system is negatively impacting surface water quality along Jay Hawk Creek and groundwater quality in the area. Groundwater movement is generally towards the north or moderately towards the northwest, based upon groundwater level data collected during this study, in addition to Hackett et al., 1960, Slagle 1995, and Custer and Schaffer 2008. Water table elevations were calculated using approximate ground surface elevations estimated from Google Earth Imagery, depth to water records from field data collection, and field notes regarding well construction. Monitoring well 3-S is considered up-gradient of the lagoon system, while monitoring wells 1-W and 2-N are considered generally down-gradient of the lagoon system **(Figure 3)**.

4.0 RESULTS

4.1 Historical Surface Water and Groundwater Data

Historical data for the monitoring wells and Jay Hawk Creek indicate that there may have been an impact to groundwater and surface water from wastewater as early as 1982. Data from monitoring well 1-W indicate two out of three samples taken between December of 1982 and October of 1983 tested positive (contaminated) for fecal coliform bacteria. In samples taken from monitoring well 2-N between December of 1982 and October of 1983, one out of four samples tested positive (contaminated) for fecal coliform bacteria. Data from 1989 show that Jay Hawk Creek above the lagoon had an ammonia level of <0.01 mg/L and total phosphorus of 0.032 mg/L, while Jay Hawk Creek below the lagoon and the I/P beds had an ammonia level of 0.11 mg/L and total phosphorus of 0.151 mg/L.

4.2 2011 - 2013 Surface Water and Groundwater Data

During this project investigation in 2011, 2012, and 2013, additional data were collected. Effluent samples were collected from the manhole (where wastewater is discharged from the settling basin and moves to the I/P beds), while groundwater samples were collected from the three monitoring wells (1-W, 2-N, and 3-S) in 2011 and 2012. In 2013, one sample was collected from the outlet of the lagoon drain pipe, and one sample was collected from a groundwater seep along the bank of Jay Hawk Creek.

Table 1. *E. coli* results for the groundwater monitoring wells (1-W, 2-N, and 3-S) and the manhole effluent. *E. coli* bacteria were not detected (ND) in any monitoring well samples but were present in the manhole effluent. (CFU= colony forming units; TNTC = too numerous to count)

Location Sampled	Collection Date	Bacteria, *E. coli* (CFU/100 ml)
Manhole Effluent	11/29/2011	TNTC
Monitoring Well – 1-W (Down-gradient)	11/29/2011	ND
	3/21/2012	ND
Monitoring Well – 2-N (Down-gradient)	11/29/2011	ND
	11/29/2011	ND (duplicate)
	3/21/2012	ND
Monitoring Well – 3-S (Up-gradient)	11/29/2011	ND
	3/21/2012	ND

In the 2011 and 2012 data, only the manhole effluent tested positive for *E. coli*. In all other samples, *E. coli* was not detected (ND) (**Table 1**). Total ammonia-N concentrations from the manhole effluent from November 2011 and March 2012 were 27.4 and 19.8 mg/L, respectively, while nitrate + nitrite-N levels remained below 0.10 mg/L in the same samples (**Table 2**). This is typical of wastewater, where ammonia has not undergone the transformation to nitrate. Down-gradient monitoring well 1-W, to the west of the I/P beds, had total ammonia-N levels of 3.84 and 3.25 mg/L, in November 2011 and March 2012 while TKN values were 4.3 and 4.0 mg/L, respectively and nitrate + nitrite-N was not detected in either case (**Table 2**). In down-gradient monitoring well 2-N, north of the I/P beds, nitrate + nitrite-N was only detected in the March 2012 sample at a level of 0.02 mg/L while TKN and total ammonia-N were at least one order of magnitude greater (**Table 2**). Monitoring well 3-S, up-gradient of the lagoon system, had non-detectable total ammonia-N levels and TKN, while nitrate + nitrite-N levels were 0.05-0.12 mg/L. Given that TKN results were greater than total ammonia-N results; the difference indicates measurable organic nitrogen is present in all samples except those from monitoring well 3-S and the lagoon drain. Orthophosphate-P levels were higher in down-gradient monitoring well 1-W when compared to the other down-gradient monitoring well, 2-N, and up-gradient monitoring well 3-S. Levels of orthophosphate-P in down-gradient wells 1-W and 2-N were notably lower than those levels found within the manhole effluent. This indicates reduction of orthophosphate-P concentrations in groundwater via the I/P beds and/or sediments and substrate located between the beds and the monitoring wells.

Table 2. Nutrient results for the groundwater monitoring wells (1-W, 2-N, and 3-S), manhole effluent, lagoon drain, and a groundwater seep. US EPA maximum contaminant level for nitrate-N = 10 mg/L, US EPA maximum contaminant level for nitrite-N = 1 mg/L. (ND = Not detected)

Location Sampled	Collection Date	Total Ammonia -N (mg/L)	Total Kjeldahl N (mg/L)	Nitrate + Nitrite-N (mg/L)	Orthophosphate -P (mg/L)
Manhole Effluent	11/29/2011	27.4	30	0.02	3.32
	3/21/2012	19.8	28	0.09	2.96
Monitoring Well – 1-W (Down-gradient)	11/29/2011	3.84	4.3	ND	0.046
	3/21/2012	3.25	4.0	ND	0.063
Monitoring Well – 2-N (Down-gradient)	11/29/2011	0.44	0.5	ND	0.010
	11/29/2011	0.44 (duplicate)	1.0 (duplicate)	ND (duplicate)	0.008 (duplicate)
	3/21/2012	0.51	0.8	0.02	0.012
Monitoring Well – 3-S (Up-gradient)	11/29/2011	ND	ND	0.05	0.017
	3/21/2012	ND	ND	0.12	0.017
Lagoon Drain	2/28/2013	ND	ND	ND	0.019
Seep	2/28/2013	0.71	1.9	0.02	0.015

Table 3. Boron and chloride wastewater tracer results for the groundwater monitoring wells (1-W, 2-N, and 3-S), manhole effluent, lagoon drain, and a groundwater seep. (ND = Not detected)

Location Sampled	Collection Date	Boron (mg/L)	Chloride (mg/L)
Manhole Effluent	11/29/2011	0.11	33
	3/21/2012	0.11	26
Monitoring Well – 1-W (Down-gradient)	11/29/2011	0.03	5
	3/21/2012	ND	7
Monitoring Well – 2-N (Down-gradient)	11/29/2011	0.02	6
	11/29/2011 (duplicate)	0.02 (duplicate)	6 (duplicate)
	3/21/2012	ND	6
Monitoring Well – 3-S (Up-gradient)	11/29/2011	0.01	2
	3/21/2012	ND	3

Lagoon Drain	2/28/2013	ND	2
Seep	2/28/2013	ND	10

Chloride and boron levels can be elevated in wastewater from human use and consumption of products with these constituents, (U.S. EPA 2002, U.S. EPA 2008). Because these are relatively conservative, they can be used as wastewater tracers and elevated levels can indicate influence of wastewater on water resources. Chloride levels in monitoring well 3-S (up-gradient) were 2 mg/L and 3 mg/L in November of 2011 and March of 2012, respectively, while chloride levels in all samples from the down-gradient monitoring wells (1-W, 2-N) ranged from 5 – 7 mg/L (**Table 3**). Boron levels, when detected, were higher in the down-gradient monitoring wells when compared to the up-gradient monitoring well.

Field parameter data for the groundwater wells show that groundwater in monitoring wells 1-W and 2-N had DO (in mg/L) levels an order of magnitude lower than up-gradient groundwater DO levels (**Table 4**), and SC concentrations (in µS/cm) were greater in down-gradient monitoring wells than in the up-gradient well.

Table 4. Field parameter data for the groundwater monitoring wells (1-W, 2-N, 3-S), manhole effluent, lagoon drain, and a groundwater seep.

Location Sampled	Collection Date	Temp (°C)	SC (µS/cm)	DO (% sat)	DO (mg/L)	pH
Manhole Effluent	11/29/2011	1.2	750	2.4	0.35	6.51
	3/21/2012	5.65	574	3.2	0.40	6.33
Monitoring Well – 1-W (Down-gradient)	11/21/2011	11.26	352	----	0.45	6.49
	11/29/2011	11.09	394	2.7	0.29	6.34
	3/21/2012	7.26	388	2.0	0.23	6.03
Monitoring Well – 2-N (Down-gradient)	11/29/2011	7.37	400	2.8	0.35	6.47
	3/21/2012	6.56	334	1.6	0.19	5.39
Monitoring Well – 3-S (Up-gradient)	11/21/2011	7.16	268	----	1.95	6.34
	11/29/2011	7.04	292	18.6	2.26	5.49
	3/21/2012	4.82	305	46.8	5.99	5.34
Lagoon Drain	2/28/2013	6.69	297	26.2	3.20	6.64
Seep	2/28/2013	4.31	356	6.8	0.88	6.50

Field parameter data was also collected in 29 stations within Jay Hawk Creek adjacent to the WWTF (**Figures 3, 4**). From upstream to downstream along the stream reach monitored, pH and DO generally decreased slightly mid-reach near the WWTF while temperature and SC generally increased along the length of the stream reach. In all groundwater well samples throughout the project the pH was lower than that of all stream reach locations that were monitored in March of 2012.

Additional water samples were collected in February of 2013 from the lagoon drain pipe, exposed in the east bank of Jay Hawk Creek, and a seep on the east bank of Jay Hawk Creek, approximately 160’ north of the lagoon drain pipe. Total ammonia-N, nitrate + nitrite-N, and TKN were not detected in the lagoon drain sample, while these same analytes were reported at levels of 0.71 mg/L, 0.02 mg/L, and 1.9 mg/L, respectively, in the seep sample (**Table 2**). At the same time, DO in the lagoon drain was 3.20 mg/L while DO in the seep was 0.88 mg/L (**Table 4**).

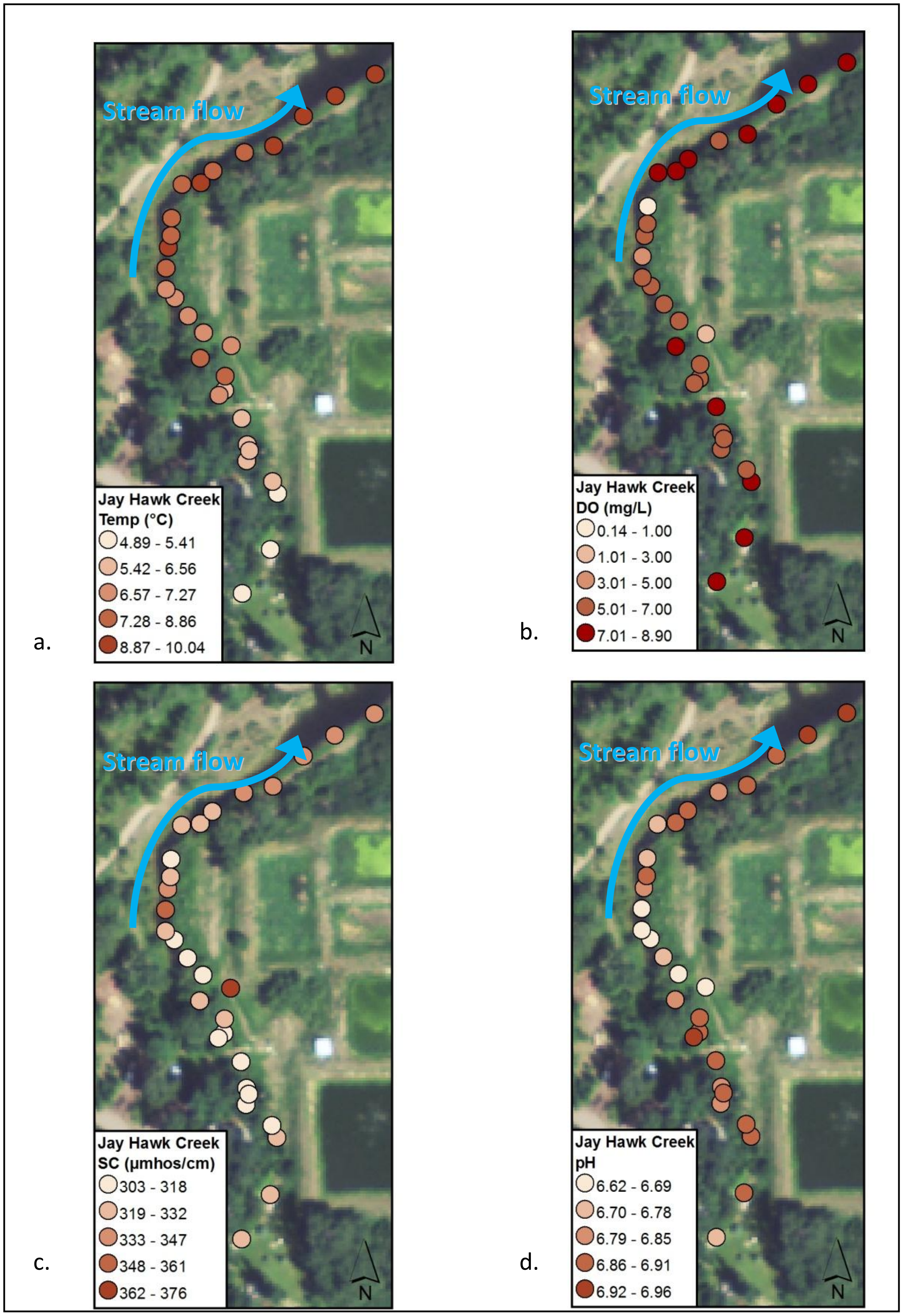

Figure 4. Field parameter data (***a:*** temperature, ***b:*** dissolved oxygen, ***c:*** specific conductance, and ***d:*** pH) shown spatially for conditions in Jay Hawk Creek on March 21, 2012. As Jay Hawk Creek flows north, temperature and conductivity generally increase along the creek reach. pH and dissolved oxygen decrease only slightly in the middle of the stream reach, as the stream passes near the I/P beds.

5.0 DISCUSSION/CONCLUSION

Nutrients and wastewater tracers evaluated in this study indicate that nitrification is incomplete during the wastewater treatment process and groundwater is influenced by wastewater in down-gradient monitoring wells in terms of increased nitrogen, conductivity, boron and chloride, and decreased dissolved oxygen. Surface water effects from the wastewater include an increase in conductivity and a decrease in dissolved oxygen. It is possible that nitrogen in groundwater entering the surface water is contributing to undesirable aquatic life in Jay Hawk Creek. The installation and comparison of an up-gradient monitoring well was critical in order to assess up-gradient groundwater conditions and for comparability of down-gradient groundwater conditions.

High biochemical oxygen demand (BOD) and low DO are characteristic of wastewater as microbial processing of nutrients and wastewater constituents requires oxygen. Because of this, the influence on groundwater can be partially evaluated by measuring DO levels. Low oxygen conditions in down-gradient monitoring wells (ranging between 0.19 to 0.45 mg/L of DO) are contrary to those levels in the up-gradient monitoring well (1.95-5.99 mg/L of DO). Anoxic conditions, less than ~0.5 mg/L of DO, can inhibit nitrification of ammonia, yet are required for the denitrification process, in which nitrate is converted to dinitrogen gas. As such, it is logical that high total ammonia-N in down-gradient wells was found along with very low or non-detectable nitrate + nitrite-N levels, while up-gradient well 3-S had non-detectable total ammonia-N levels and nitrate + nitrite-N levels of 0.05-0.12 mg/L.

Furthermore, SC as well as chloride and boron, two relatively conservative solutes, were used as wastewater tracers in groundwater samples. When chloride was evaluated, the down-gradient monitoring wells had approximately two times the concentration of that found in the up-gradient well. Boron and SC levels were also higher in the down-gradient wells.

Increasing temperature through the measured reach of Jay Hawk Creek as water passed near the wastewater treatment facility in March 2012 is likely due to warmer groundwater entering the cooler stream water. An increase in SC along the measured reach demonstrates the influence of higher conductivity wastewater effluent entering groundwater and eventually Jay Hawk Creek. Longitudinal pH and DO trends in Jay Hawk Creek show decreasing levels when the stream passed near the WWTF, possibly a result of lower pH and lower DO groundwater entering the creek. These effects of decreased pH and DO, however, appear to be diluted by the end of the monitored reach. Dilution of the increased temperature and increased SC is incomplete by the end of the measured steam reach. Although nutrient data was not collected for Jay Hawk Creek during this project investigation, field parameter data is indicative of likely wastewater and groundwater influence on surface water. The most recent available stream ammonia and nitrate data is from the MT DEQ Enforcement Division, sampled in January of 2008 and shows nitrate + nitrite-N of 0.7 mg/L and total ammonia-N of 0.25 mg/L. MT DEQ numeric nutrient standards (0.3 mg/L total nitrogen and 0.03 mg/L total phosphorus) for streams in the Middle Rockies ecoregion do not apply outside of July 1st to September 30th (Montana DEQ 2014), therefore these results from winter and spring cannot be compared to those criteria, nor is the information available to make this comparison.

The additional water samples that were collected in February of 2013 from the lagoon drain pipe (pipe draining shallow groundwater from underneath the lagoon liner) had non-detectable total ammonia-N, nitrate + nitrite-N, TKN, as well as oxic conditions. This indicates that groundwater being drained by this pipe does not appear to be affected by wastewater in the lagoon; therefore there is no evidence of lagoon leakage. The wastewater influence on groundwater and surface water likely results from the fact that the effluent entering the I/P beds infiltrates directly into the subsurface, according to the 2011 DEQ inspection report, rather than dispersing across the I/P beds.

It is likely that effects on groundwater and Jay Hawk Creek may not be measurably affecting the West Gallatin River because of dilution by the large volume of water in the river relative to that of the Jay Hawk Creek tributary. However, various logistical constraints during this project prevented the data collection necessary to confirm this.

Attenuation of nutrients and wastewater tracers is incomplete by the time the wastewater-influenced groundwater enters Jay Hawk Creek. The Forest Park Mobile Home Park WWTF does appear to be affecting groundwater as well as surface water quality when assessed by nutrients, wastewater tracers, and water quality field parameters.

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7.0 ACKNOWLEDGEMENTS

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APPENDICES

APPENDIX A

SAMPLING PROTOCOLS AND PROCEDURES

Sampling protocols were followed using the GLWQD Standard Operating Procedures for Groundwater Sampling. This document provides sampling guidelines and describes general and specific procedures, methods and considerations to be used and observed when collecting groundwater samples for laboratory analysis of general inorganics.

A YSI 556 multi-parameter field meter connected to a flow-through cell was used for collecting field parameter data (pH, specific conductance, dissolved oxygen, temperature). The meter was calibrated each day prior to going into the field following manufacturer instructions and recorded in a calibration log. The following procedures were followed for each sampling site:

1. Monitoring wells were located.
2. A site sketch was drawn on the Site Visit Form showing major features such as the wastewater treatment facility and well locations.
3. The wellhead was located and the well cap removed. Well cap and casing condition was noted and recorded on the Site Visit Form.
4. The static water level (SWL) was obtained from the well using an electronic tape sounder.
5. The YSI meter with flow-through cell was connected to the discharge line of the other side of the hose splitter valve. Water quality parameters were recorded every 5 minutes on the Site Visit Form until stabilized using the following criteria:

Parameter	Stabilization Criteria	Reference
pH	+/- 0.1	Puls and Barcelona, 1996; Wilde et al., 1998
specific conductance (SC)	+/- 3%	Puls and Barcelona, 1996
dissolved oxygen (DO)	+/- 0.3 mg/L	Wilde et al, 1998

6. Three well volumes were purged and a pumping water level was recorded on the Site Visit Form a minimum of one time during the purging process.
7. Wearing disposable gloves, water was pumped using a peristaltic pump. All sample bottles were triple rinsed with native water prior to sample collection. Samples were preserved, as appropriate. Samples were placed in a one-gallon Ziploc bag and stored in a cooler on ice.
8. Samples were shipped to the laboratory via overnight carrier along with a completed chain of custody form.