

***Reconnaissance of West Brook and
Little 5 Mile Creeks
Fayette County, Texas***

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**RECONNAISSANCE OF WEST BROOK
AND LITTLE 5 MILE CREEKS
FAYETTE COUNTY, TEXAS**

Prepared for:

MCA Petroleum
P.O. Box 1287
San Marcos, Texas 78676

Prepared by:

Atkins
6504 Bridge Point Parkway, Suite 200
Austin, Texas 78730

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SUMMARY

David Buzan, Atkins, assisted by Catherine Shellman, MCA Petroleum, intensively sampled aquatic life in West Brook and Little 5 Mile creeks, the Southwest Muldoon Field Battery 1 holding tank, and the discharge canal from the Southwest Muldoon Field Battery 1 holding tank to its discharge into West Brook Creek. Samples were collected on March 5, 2014.

The primary purpose of the study was to identify invertebrate organisms living in the creeks, which might be acceptable for use in whole effluent toxicity tests. A secondary purpose of the study was to describe, in general terms, the creeks and their biological communities. Sampling was not intended to identify all invertebrates and vertebrates living at the sample locations and their relative abundances.

The following invertebrates were collected and may be considered as substitute toxicity test organisms:

- *Baetis* (mayfly nymph)
- *Hyalella* (amphipod)
- Family Chironomidae (midge fly larvae)
- Water fleas (seven species)

These creeks provide valuable ecological functions in this part of Texas because of their perennial nature. Most natural streams in this area cease to flow during the summer. The ecological value of West Brook and Little 5 Mile creeks has further increased because of drought. These perennial streams ensure adequate quality flowing water is available to terrestrial wildlife as well as aquatic life as natural sources of surface water become increasingly limited and further apart. Persistence of flow and acceptable water quality are reflected in the diversity and number of organisms observed, variety of their habitats, and the food web diversity they represent.

There was also diversity in tolerance to environmental stress. The observed mayfly nymphs, black fly larvae, and grass shrimp are considered relatively intolerant to stress while the snails and some of the midge fly larvae tolerate stress relatively well.

Raccoon tracks along the creek combined with reports of river otters living in a pond on West Brook Creek indicate these mammals are obtaining food from the creek, probably crayfish and fingernail clams. Utilization by terrestrial wildlife reflects how the ecological functions of these creeks extend beyond the water's edge to the wildlife inhabiting the adjacent riparian zone.

SAMPLING SITES

Sampling locations were in Fayette County, northwest of the town of Flatonia (Figure 1).

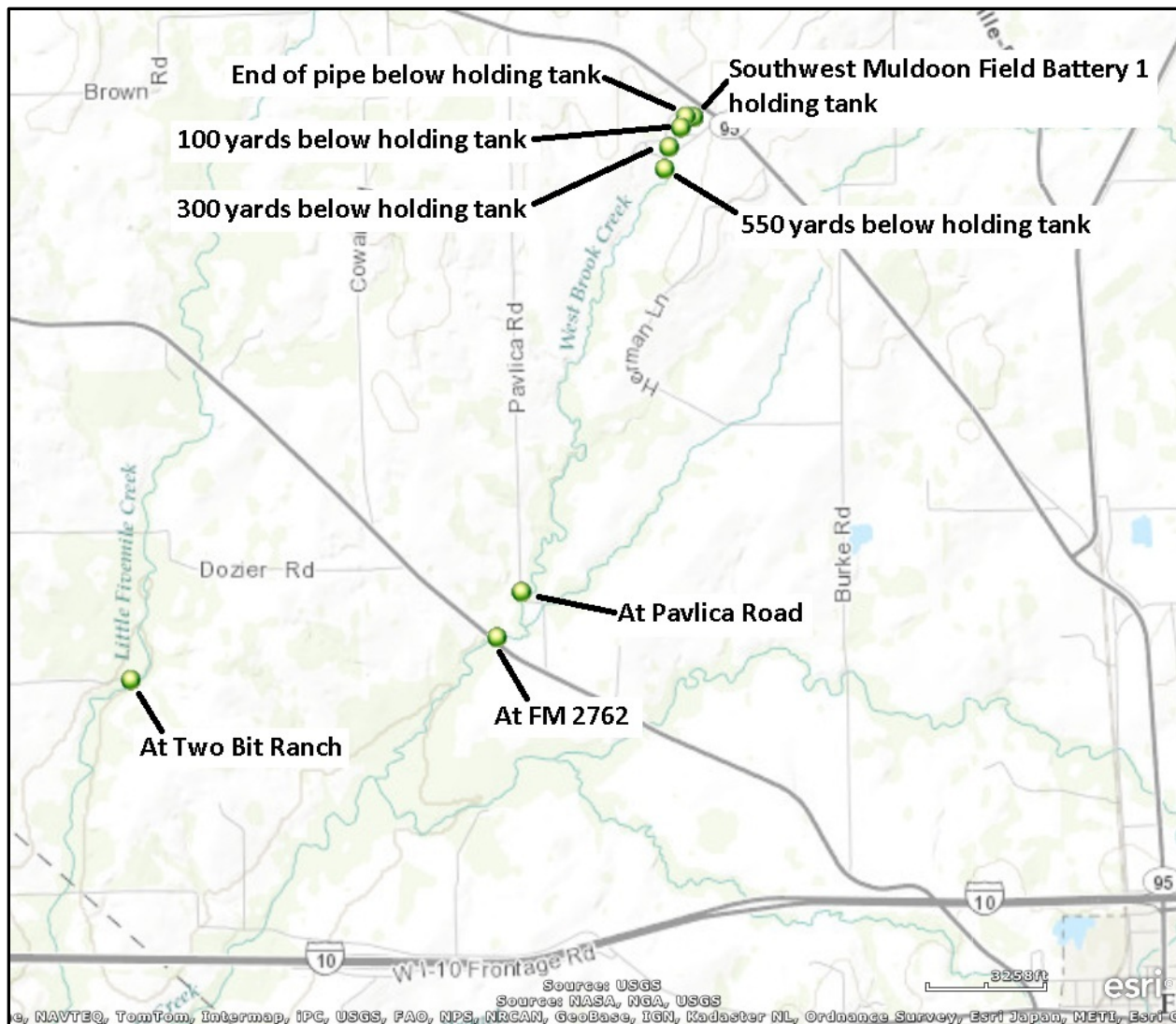


Figure 1. March 5, 2014 study area.

- Southwest Muldoon Field Battery 1 Holding Tank,
- Southwest Muldoon Field Battery 1 discharge canal (3 locations),
- West Brook Creek at Pavlica Road and Farm-to-Market road 2762, and
- Little 5 Mile Creek at Devine Road on Two Bit Ranch

West Brook Creek and Little 5 Mile Creek, which is the watershed on the west side of West Brook Creek, join to form Big 5 Mile Creek. Big 5 Mile Creek flows into Peach Creek, which flows into the Guadalupe River southeast of Gonzales. There was no flow or water in West Brook Creek, upstream of the Southwest Muldoon Field Battery 1 holding tank on March 5. The creek's headwaters and defined stream channel begin about 500 yards downstream of the discharge from the holding tank.

There are about 115,000 gallons (2,750 barrels) per day of produced water discharged from the facility.

Little Five Mile Creek has six, fresh, produced water discharges flowing into it. Its headwaters begin at the MCA, Glen McCrory Discharge Facility. There are 78,000 gallons (1,850 barrels) per day of produced water discharged into Little 5 Mile Creek. Facilities discharging into Little 5 Mile Creek are in Elm Grove, Arnim, and East Arnim Fields. Two Bit Ranch, where biological samples were collected, is downstream of four of the six facilities.

METHODS

Field water chemistry was measured with a Yellow Springs Instrument 600 XLM V2 water quality meter. Net plankton were collected in a Wisconsin plankton net with a mouth diameter of 5 inches and equipped with 0.064-millimeter mesh nylon, Nitex, netting. Invertebrate samples were collected with a triangular frame kick net equipped with 0.5-millimeter mesh net.

Net plankton were collected in the creeks by pouring buckets of water into the Wisconsin net. Because of the shallow, narrow nature of the creeks, these plankton samples collected organisms near the bottom and near aquatic plants.

The kick net was swept through aquatic plants in the creeks and along the shore, on creek bottoms, through submerged piles of leaves, and through roots and branches hanging into the water. The kick net was also dug into the creek bottom. It was swept through a cobble and gravel riffle in West Brook Creek at Pavlica Road. This was the only rock riffle encountered during the day.

There was not an attempt to identify all organisms collected or to identify all organisms to the lowest possible taxonomic level because of the large number of organisms encountered. Emphasis was placed on detailed identification of mayflies, scuds (amphipods), and water fleas (cladocera) in the effort to find substitute toxicity test organisms.

WATER CHEMISTRY

Field water chemistry is summarized in Table 1. Dissolved oxygen exceeded 4 milligrams per liter in all measurements. Specific conductance is a measure of the salt content of the water and ranged from 740 to 1,200 micromhos/centimeter. For comparison, specific conductance in Peach Creek at County Road 353 in Gonzales County ranged from 100 to 1,680 micromhos/centimeter from October 1996 through December 2013 (Guadalupe-Blanco River Authority, 2014). The water quality criterion for salts in the Guadalupe River below its confluence with the San Marcos River is an annual average of 769 micromhos/centimeter (Texas Commission on Environmental Quality, 2010, 2012).

Table 1. Field water chemistry on March 5, 2014

Variable	Southwest Muldoon Field Battery 1 Holding Tank	West Brook Creek at Pavlica Road	West Brook Creek at Farm-to-Market Road 2762	Little 5 Mile Creek at the Two Bit Ranch
Time (Central Standard Time [CST])	16:17	08:34	10:34	13:55
Depth (feet)	1.0	0.5	0.3	0.3
Water temperature (°F)	58.7	44.5	45.6	47.7
Specific conductance (micromhos/centimeter)	750	750	740	1,200
Dissolved oxygen (milligrams/liter)	10.0	7.4	8.4	4.2
Secchi Disk Transparency (inches)	>36 (estimated)*	7		6

*Secchi disk transparency was not measured in the holding tank because it was not possible to wade to a great enough depth to measure where the Secchi disk would disappear from view.

Anoxic sediments or accumulations of organic matter were not detected at any of the sample locations despite extensive digging in the creek bottoms with the kick net.

SUBSTITUTE TOXICITY TEST ORGANISMS

Appendix B, Supplemental List of Acute Toxicity Test Species, guided the search for substitute toxicity test organisms (U.S. Environmental Protection Agency, 2002). Samples have not shown toxicity to fathead minnow fry; therefore, this effort focused on identifying substitute invertebrates. The following invertebrates listed in Appendix B were collected:

- *Baetis* (mayfly nymph) at West Brook Creek at Pavlica Road and Little 5 Mile Creek at Two Bit Ranch
- *Hyalella* (amphipod) at West Brook Creek at Farm-to-Market Road (FM) 2762
- Family Chironomidae (midge fly larvae) in the plankton and kick net sweeps at all locations

Emphasis was placed on identifying water fleas present in the creeks since the water flea, *Daphnia pulex*, is commonly used for toxicity testing and other species might be considered for testing although none are listed in Appendix B. Seven species of water fleas were identified:

- *Simocephalus (vettulus?)* – collected at all locations and most abundant in Little 5 Mile Creek
- *Ceriodaphnia (reticulata?)* – collected in the holding tank and Little 5 Mile Creek
- *Chydorus (sphaericus?)* – collected in West Brook and Little 5 Mile creeks
- *Camptocercus (rectirostris?)* – collected in the holding tank and Little 5 Mile Creek
- *Scapholeberis (kingii?)* – collected in Little 5 Mile Creek

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- *Pleuroxus (denticulatus?)* – collected in West Brook Creek
 - *Streblocerus (?)* – collected in the holding tank

OBSERVATIONS OF BIOLOGICAL COMMUNITIES

SOUTHWEST MULDOON FIELD BATTERY 1 HOLDING TANK

The holding tank is a constructed oval earthen pond (Figure 2). Surface area of the tank was about a quarter of an acre and it is reported to be about 10 feet deep. Discharge from the Southwest Muldoon Field Battery 1 skim pit enters the east side of the tank and exits the west side of the tank from subsurface pipes. The water in the tank appeared clear with an estimated Secchi disk transparency of at least 3 feet.

The shoreline of the tank has a 1- to 2-foot-wide band of spike rush interspersed with *Spirogyra* (filamentous green algae). A kick net sweep of the spike rush revealed damselfly and dragonfly nymphs, and frogs.

Net plankton were collected by throwing the Wisconsin net to the center of the pond and retrieving it to the shoreline four times. The four tows were composited into one sample. Sample depth ranged from 2 feet to just below the surface. The net plankton community was dominated by cyclopoid copepods. The estimated density of these copepods was about 8 juveniles (nauplii and copepodites) and 2 adults per liter of water.

Other organisms collected in the net plankton included (Figure 3):

Invertebrates	Algae
Rotifer (<i>Synchaeta</i>)	<i>Campylodiscus</i> (unicellular diatom)
Unidentified rotifer (possibly <i>Conochilus</i>)	<i>Navicula confervacea</i> (colonial diatom)
Midge fly larvae (Chironomidae)	
Seed shrimp (ostracods)	
Bryozoan flotoblast	
Water flea (<i>Streblocerus</i>)	
Water flea (<i>Ceriodaphnia (reticulata?)</i>)	
Water flea (<i>Simocephalus (vettulus?)</i>)	
Water flea (<i>Camptocercus (rectirostris?)</i>)	

Four species of water fleas were encountered in the plankton samples. *Ceriodaphnia* is the only water flea normally found in open water away from the shore. The other three species are typically found around aquatic plants.



Figure 2. Southwest Muldoon Field Battery 1 Holding Tank on March 5, 2014.
Photo by David Buzan, Atkins, at 16:10 CST. Top photo of west side of tank.
Bottom photo of east side of tank showing discharge into tank from the skim pits.



Figure 3. Cyclopoid copepod nauplius on the left and *Ceriodaphnia* on the right from holding tank plankton. Photos by David Buzan.

DISCHARGE CHANNEL FROM SOUTHWEST MULDOON FIELD BATTERY 1 HOLDING TANK DOWNSTREAM TO WEST BROOK CREEK

The discharge channel is a constructed, open, earthen discharge channel about 12 feet wide and about 500 yards long. Water depth on March 5, 2014, was generally less than 6 inches in the channel and did not exceed a foot (Figure 4). The channel has extensive growths of spike rush and filamentous green algae. Water was clear throughout the length of the discharge channel. About 500 yards downstream of the holding tank, the channel discharges into a natural stream bed which becomes West Brook Creek. There was evidence of cattle having crossed the discharge channel.

Invertebrates observed in the discharge channel kick net samples included dragonfly and damselfly nymphs, midge larvae, snails (*Physella*), and diving beetles. Vertebrates observed in the discharge channel included Western Mosquitofish (*Gambusia affinis*) and cricket frogs (*Acris*) (Figure 5).

WEST BROOK CREEK AT PAVLICA ROAD

West Brook Creek was sampled at Pavlica Road, 3.5 stream miles downstream of the end of the discharge channel (Figure 6). The creek is narrow, generally less than 6 feet wide, shallow (less than 1.5 feet deep), and dominated by small runs, glides, and pools. One gravel and cobble riffle was present downstream of the bridge. Estimated flow in the creek was 0.3 cubic foot per second. Duckweed (*Lemna*) covered part of the creek. This was the only location at which duckweed was observed. Rooted macrophytes were present.



Figure 4. Southwest Muldoon Field Battery 1 discharge channel on March 5, 2014 at 16:50 CST.

Top photo shows the view towards the holding tank from a point about 100 yards downstream of the holding tank.

Bottom photo illustrates the view from the same point towards West Brook Creek. Photos by Catherine Shellman.



Figure 5. Cricket frog (on left) and Mosquitofish (on right). Photos by Catherine Shellman.

Net plankton were collected by pouring about 30 gallons of water through the Wisconsin net.

Organisms collected in the net plankton and kick net sweeps included (Figure 7):

Net Plankton
Water flea (<i>Chydorus (sphaericus?)</i>)
Water flea (<i>Simocephalus (vettulus?)</i>)
Juvenile copepods (nauplii)
Midge fly larvae (Family Chironomidae)
Kick Net Sweeps
Mayfly nymphs (<i>Baetis</i> sp)
Crayfish (Family Cambaridae)
Snail (<i>Physella</i>)
Snail (<i>Helisoma</i>)
Fingernail clam (Family Sphaeriidae) – most abundant in the mud
Leeches – most abundant in the mud
Aquatic worms (oligochaetes) – most abundant in the mud
Midge fly larvae (Family Chironomidae)
Mosquitofish (<i>Gambusia affinis</i>)
Damselfly nymphs
Black fly larvae (Family Simuliidae) – only in the riffle
Aquatic beetles (Family Gyrinidae, Family Haliplidae, and diving beetles)



Figure 6. West Brook Creek at Pavlica Road on March 5, 2014 at 08:30 CST.

Top photo is view towards upstream from bridge.

Bottom photo is view towards downstream from bridge.

Photos by David Buzan.

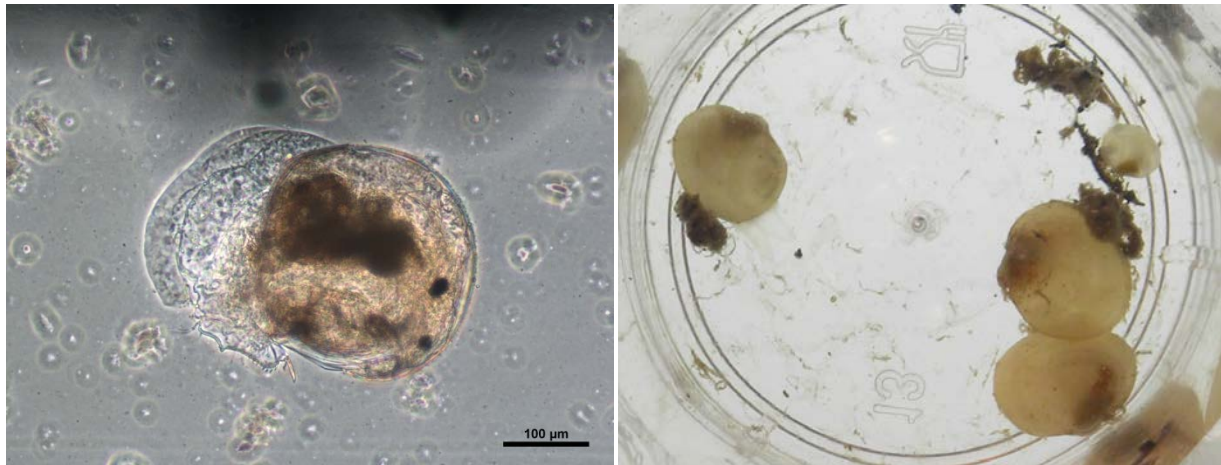


Figure 7. *Chydorus (sphaericus?)* on left at magnification of 100 (photo by Dave Buzan) and fingernail clams on right (photo by Catherine Shellman).

WEST BROOK CREEK AT FM 2762

West Brook Creek was also sampled at FM 2762, about 4 stream miles downstream of the Southwest Muldoon Field Battery 1 discharge channel and about 0.5 stream mile downstream of the Pavlica Road crossing (Figure 8). Creek water quality, habitat, and estimated flow were similar to the creek at Pavlica Road. There were signs of livestock next to the creek.

Net plankton were collected by pouring about 45 gallons of water through the Wisconsin net.

Organisms collected in the net plankton and kick net sweeps included (Figure 9):

Net Plankton
Water flea (<i>Simocephalus (vettulus?)</i>)
Water flea (<i>Pleuroxus (denticulatus?)</i>)
Juvenile copepods (nauplii)
Cyclopoid copepods
Midge fly larvae (Family Chironomidae)
Unidentified rotifers
Bryozoans flotoblasts
Unicellular algae (<i>Closterium</i> , <i>Surirella</i> , <i>Gyrosigma</i>)



Figure 8. West Brook Creek at FM 2762 on March 5, 2014 at 10:30 CST.
Top photo is view towards upstream from bridge.
Bottom photo is view towards downstream from bridge.
Photos by David Buzan.

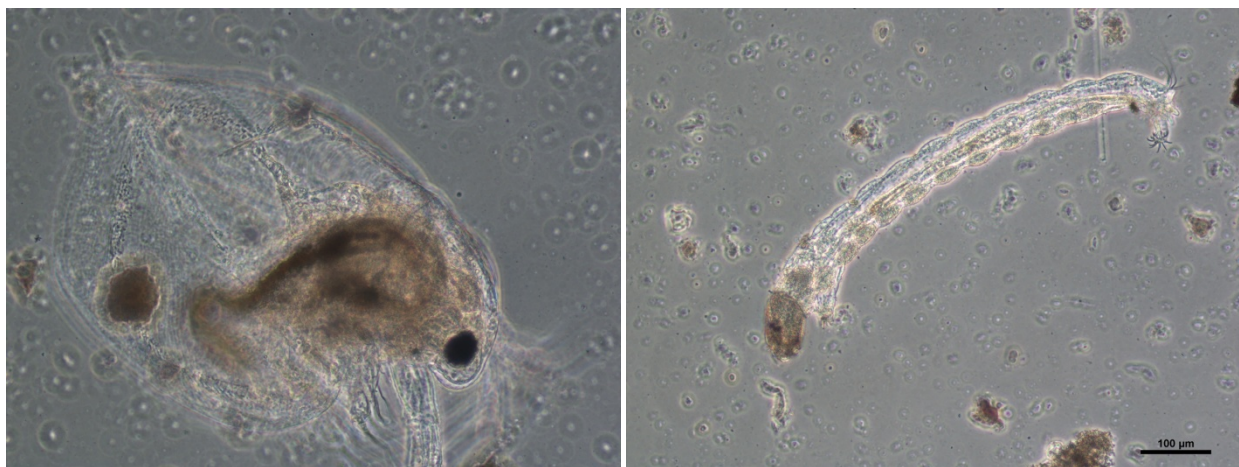


Figure 9. Water flea (*Simocephalus (vettulus?)*) and midge fly larva. Photos by David Buzan.

Kick Net Sweeps
Grass shrimp (<i>Palaemonetes</i>)
Crayfish (Family Cambaridae)
Snail (<i>Physella</i>)
Snail (<i>Helisoma</i>)
Fingernail clams
Leeches – most abundant in the mud
Aquatic worms (oligochaetes)
Midge fly larvae (Family Chironomidae)
Mosquitofish (<i>Gambusia affinis</i>)
Damselfly nymphs
Dragonfly nymphs
Scuds (<i>Hyaella</i>)
Aquatic beetles (including Family Haliplidae and diving beetles)

LITTLE 5 MILE CREEK AT TWO BIT RANCH

Little 5 Mile Creek was sampled at Two Bit Ranch (Figure 10) at Devine Road just east of Armstrong Derry Road. Creek habitat was similar to West Brook Creek. Estimated flow was 0.3 cubic foot per second. Water primrose was observed at this location. Specific conductance was higher and dissolved oxygen was lower in Little 5 Mile Creek than in West Brook Creek. Cattle tracks crossed the creek in at least two different locations.

Net plankton were collected by pouring about 40 gallons of water through the Wisconsin net.

Organisms collected in the net plankton and kick net sweeps included (Figure 11):

Net Plankton
Water flea (<i>Simocephalus (vettulus?)</i>) - particularly abundant around water primrose
Water flea (<i>Chydorus (sphaericus?)</i>)
Water flea (<i>Camptocercus (rectirostris?)</i>)
Water flea (<i>Scapholeberis (kingii)</i>)
Water flea (<i>Ceriodaphnia</i>)
Juvenile copepods (nauplii and copepodites)
Cyclopoid copepods
Midge fly larvae (Family Chironomidae)
Seed shrimp (ostracods)
Kick Net Sweeps
Mayfly nymphs (<i>Baetis</i>)
Grass shrimp (<i>Palaemonetes</i>)
Crayfish (Family Cambaridae)
Snail (<i>Physella</i>)
Snail (<i>Helisoma</i>)
Fingernail clams (Family Sphaeriidae)
Midge fly larvae (Family Chironomidae)
Mosquitofish (<i>Gambusia affinis</i>)
Damselfly nymphs
Dragonfly nymphs
Aquatic beetles (including Family Haliplidae and diving beetles)
Tadpoles (two species, unidentified)



Figure 10. Little 5 Mile Creek at Two Bit Ranch on March 5, 2014 at 14:00 CST.
Photos by David Buzan.



Figure 11. Grass shrimp and crayfish representative of specimens collected from Little 5 Mile Creek. Photo by Catherine Shellman.

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