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OCT 15 2018

Oklahoma Water Resources Board



10/15/2018

**Oklahoma Water Resources Board**

**Attn: Planning & Management Division: Kent Wilkins**

3800 N Classen Boulevard, Oklahoma City, OK 73118

RE: Hatch Mine Pit Water Management Plan

Mr. Wilkins,

Please find enclosed a Pit Water Management Plan (Plan) in the name of Covia Holdings Corporation (Covia) for the non-exempt mining site referred to as the Hatch Mine. This Plan has been prepared in accordance with the requirements set forth in OWRB Rules (785:30-15) related to the use and disposal of water trapped in a producing mine that overlies a sensitive groundwater basin. This Plan is being officially submitted to the Oklahoma Water Resources Board (OWRB) for approval as required by OWRB Rules. This Plan has been reviewed by representatives of Covia who have officially requested the submittal to the OWRB for approval.

The official submittal of this Plan follows a Plan consultation meeting that was held on September 21, 2018 between OWRB staff, Covia representatives, and myself. While not officially submitted for approval at that time, OWRB staff did have a chance to see a draft copy of the Plan, ask questions, and offer suggestions related to the Plan. As a result of this meeting several of the suggestions made by OWRB staff were integrated into the Plan. The final Plan included here for approval includes additional information related to these suggestions.

Covia is officially requesting that upon receipt of this Plan that if possible, a response letter be provided confirming that there was a consultation meeting related to the Plan as well as official submission of the Plan as required by OWRB Rules. If you have any questions related to this letter or the Plan please do not hesitate to contact me by phone or email.

Sincerely,

**Anthony Mackey**

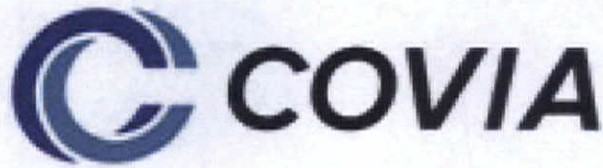
Owner

Enclosure

cc: Shelby Hudgens, General Manager – Environmental Engineering, Covia

Jim Bonsall, Plant Manager, Covia





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# PIT WATER MANAGEMENT PLAN

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## HATCH MINE PONTOTOC COUNTY, OKLAHOMA

Published: 10/12/2018

**Covia Holdings Corporation**  
PO Box 159  
600 East Walling Street  
Roff, OK 74865

Prepared by:



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## PROPOSED NON-EXEMPT MINE SITE

This Management Plan has been prepared in accordance with the requirements set forth in Oklahoma Water Resources Board (OWRB) Rules (785:30-15) related to the use and disposal of water trapped in a producing mine that overlies a sensitive groundwater basin. This plan is related to the operation of a proposed mine site, referred to as the Hatch Site, that will be owned and operated by Covia Holdings Corporation.

The current plan for the proposed mine site will cover an area of approximately 20 acres when operations are at their peak. This proposed site is located near (east of) Roff, Oklahoma in the S2 SE of Section 19-2N-5E1M in Pontotoc County. In addition, this site will be located next to an existing exempt mine site, which is located to the east and south of the proposed mine site. The proposed location of the mine site contains no identified creeks or streams and has a drainage area of approximately 65 acres.

It is anticipated that the majority of the water used and/or disposed of and removed from the mine pit will be surface runoff or direct precipitation into the pit. The total time anticipated for mining activities from the start of operations to the end is approximately 2 to 3 years. It is anticipated that any groundwater encountered and thus used and/or disposed of from the mine will not occur until near the end of the operations. This is based upon observations, activity, and data related to the exempt mine located next to this proposed location, as well as, the anticipated final depth of the proposed mine. All this information and data indicates that the mine will most likely not encounter the natural water table until the last phase of the mining operation.

Note all water volumes shown in this plan are based upon maximum anticipated flows during the peak operation of the site. All volumes are estimates based upon the best available data at the time this plan was generated. Any future changes, updates, and/or amendments to this plan will be presented to the OWRB for review and approval.

## MANAGEMENT PLAN ELEMENTS

Listed below is the information relevant to the proposed site as required by OWRB Rules 785:30-15-16(a).

### Element 1 (Characterization of Area):

The proposed mine site will be comprised of one mine pit from which groundwater and/or pit water will be removed to allow for the operation of the mine site. In addition, one settling/retention impoundment will use used when needed. All materials from this site will be processed at the same processing facility as the current exempt mining operation.

The location of the proposed mine pit, settling/retention impoundment, and processing facility are identified and can be seen in **Figure 1** (Page 8). The proposed mine pit overlies the Arbuckle-Simpson Groundwater Basin which has been identified as a Sensitive Basin. The Arbuckle-Simpson Groundwater Basin is made up of multiple groundwater formations. The formations (geology) that underlie the proposed mine area can be seen in **Figure 3** (Page 10).

### Element 2 (Facility Layout):

During the operation of the proposed mine site, all groundwater and/or pit water removed from the pit will either be taken to the processing facility as part of the material being mined or pumped into the settling/retention impoundment. From these locations the water will then either be discharged to a stream, left in the settling/retention impoundment, or returned to the active pit for use in the mining operation.

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All anticipated locations of groundwater and/or pit water removal, use, and/or discharge points are identified and can be seen in **Figure 1** (Page 8) and **Figure 2** (Page 9). In addition, the anticipated direction of flow of all groundwater and/or pit water between the different areas of the mining operation are identified and can be seen in **Figure 2** (Page 9).

The following are types of locations and/or points that are anticipated to be used as part of this mining operation:

1) Proposed Locations and Points:

- a. Mining Area (Pit) Location
- b. Processing Facility Location
- c. Water Storage Impoundment Location
- d. Stream Water Augmentation Location(s)
  - i. At this time there are no plans to use stream water augmentation for this mine site. However, the possible location(s) of stream water augmentation points are being included should the decision be made to use stream water augmentation.
- e. Groundwater and/or Pit Water Stream Discharge Points
- f. Groundwater and/or Pit Water Withdraw Points

**Element 3 (Water Budget):**

The proposed water budget for the proposed mine presented in this plan is based upon the anticipated conditions of the site during peak operation. The anticipated water volumes and associated flows from all elements can be seen in **Figure 4** (Page 11). In addition, all anticipated water entry and exit flows are identified and can be seen in **Figure 2** (Page 9).

The following are anticipated water elements associated with this mine location:

1) Anticipated Water Budget and Flow:

- a. Groundwater
- b. Pit Water
- c. Direct Precipitation
- d. Precipitation Runoff
- e. Evaporation
- f. Water Loss During Processing of Materials
- g. Stream Water Augmentation
  - a. At this time there are no plans to use stream water augmentation for this mine site. However, the possible location(s) of stream water augmentation points are being included should the decision be made to use stream water augmentation.
- h. Groundwater and/or Pit Water Discharged

**Element 4 (Water Rights):**

Covia owns approximately 1,055 acres located over the Arbuckle-Simpson groundwater basin (including the proposed mine site) that will be utilized for this mining operation. Covia has applied for a groundwater use permit in the name of Covia Holdings Corporation that is currently being processed and reviewed by the OWRB water rights permitting section.

The details of the groundwater permit (if approved) are listed below:

- 1) Permit #2018-524
- 2) 211.1 acre-feet
- 3) Industrial and Mining
- 4) 1,055.3 acres dedicated

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### Element 5 (Consumptive Use of Pit Water):

The anticipated estimated total amount of Consumptive Pit Water that will be used as defined by OWRB Rules 785:30-15 is based upon the anticipated peak operations of the mine site. This estimated Consumptive Pit Water Use can be seen in **Table 1** (Page 12).

### Element 6a (Groundwater Augmentation):

Currently at this time there are no plans to use or claim any groundwater augmentation credits. However, several nonactive mine pits are currently being evaluated to determine if they could be used as groundwater augmentation pits in the future. If it is determined that these pits qualify as groundwater augmentation pits and the decision is made to claim groundwater augmentation credits, all appropriate information and data will be provided to the OWRB in the form of an updated/amended plan for approval by the OWRB. No groundwater augmentation credits will be claimed until an updated/amended plan has been approved by the OWRB.

### Element 6b (Stream Water Augmentation):

At this time there are no plans to use stream water augmentation for this mine site. However, all information related to the use and claiming of stream water augmentation credits are being provided should the decision be made to use stream water augmentation.

Any groundwater and/or pit water discharged with the intent of claiming stream water augmentation credit would ultimately be discharged into the Blue River either through direct discharge or through a named or unnamed tributary. These possible locations could include the following rivers and/or creeks

- 1) Blue River
- 2) Unnamed Tributary to Blue River
- 3) Limestone Creek (Tributary to Blue River)
- 4) Unnamed Tributary to Limestone Creek

Records of any and all discharges claimed for stream water augmentation credit would be kept indicating the date, volume discharged, start and end time of discharge, and the flow in the Blue River at the time the discharge being claimed for augmentation credit. Reports showing this information will be included with all quarterly and annual reports during which augmentation credit was used.

Since the ultimate location of any augmentation discharges would be the Blue River, augmentation would only be taken when the flow of the Blue River was less than or equal to the 50% exceedance. The 50% exceedance that would be used for determination of when augmentation credit could be taken would be the one generated by USGS gage #07332390 located near Connerville, OK on the Blue River. As required by OWRB rules, the 50% exceedance for this gage would be updated annually on January 1<sup>st</sup> of each year.

USGS Stream Gage #07332390 – **Attachment 1** (Page 13)

- 1) Location – Blue River near Connerville, OK
  - a. Latitude 34°23'00", Longitude -96°36'01"
  - b. SW SW NW 17-2S-7EIM in Johnston County
- 2) Period of Record – October 1976 to September of 1979 and October 2003 to current year
- 3) 50% Exceedance – 47.1 cfs
  - a. As of May 31, 2018
  - b. Water Years 1977 – 2017

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## Element 7 (Determination of Water Amount):

In order to properly and accurately determine the total consumptive pit water amount used and/or disposed of, proper measures will be adopted and implemented to measure or make reasonable estimates of the volume of water from all sources of water.

Listed below are the sources of water and the anticipated method by which the volume will be measured or reasonably estimated:

- 1) Groundwater Entering the Pit
  - a. Calculated (Estimated)
    - i. This will be determined by subtracting any and all surface runoff, direct precipitation, and water pumped from other sources into the mine pit from the total volume removed from the pit. The remaining amount will be considered groundwater entering the pit.
- 2) Surface Runoff Entering the Pit
  - a. Calculated (Estimated)
    - i. This will be determined by calculating the amount of runoff using accepted engineering models such as the SCS Runoff Model or other acceptable models. The model will include the following data:
      1. Precipitation that falls in the drainage area of the pit.
        - a. Obtained from the Fittstown Mesonet Station
          - i. Approximately 7 Miles to the SE
            1. Latitude 34°33'7", Longitude -96°43'4"
      2. Drainage Area of Pit
        - a. Approximately 65 acres
      3. Topography
      4. Soil Type
      5. Land Use
      6. Vegetation
      7. Any other factors deemed necessary
- 3) Direct Precipitation Entering the Pit
  - a. Calculated (Estimated)
    - i. This will be determined by multiplying the amount of precipitation that falls directly on the pit by the area of the pit.
      1. Area of Pit
        - a. Approximately 20 acres at peak operation
      2. Precipitation
        - a. Obtained from the Fittstown Mesonet Station
          - i. Approximately 7 Miles to the SE
            1. Latitude 34°33'7", Longitude -96°43'4"
- 4) Water Diverted from the Pit
  - a. Measured
    - i. The amount of water diverted from the pit will be measured using a pump (either metered or calculated using pump rates and time pumped) and/or measured flow using the best method possible during times of gravity flow of water from the pit.
- 5) Disposition of Water from the Pit
  - a. Measured and/or Calculated (Estimated)

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- i. Disposition of water as a result of the processing of materials will be calculated using the determined percentage of moisture content contained in the material in relation to the amount of material removed from the pit.
    - ii. Other dispositions of water that may occur will either be measured by metered pump, calculated by pumping rates, or estimated using the best method available.
- 6) Consumptive Use of Water from the Pit
  - a. Calculated (Estimated)
    - i. The total volume of Consumptive Pit Water will be calculated using the Pit Water Consumptive Use Report (**Table 1** – Page 12) as approved by the OWRB.
- 7) Water Discharged to Stream
  - a. Measured
    - i. The amount of water diverted from the pit will be measured using a pump, either metered or calculated using pump rates and time pumped.
- 8) Precipitation at the Mine Site
  - a. Calculated (Estimated)
    - i. The amount of precipitation that falls at the mine site and drainage area will be calculated using precipitation data obtained from the Fittstown Mesonet Station located approximately 7 Miles to the SE.
      - 1. Latitude 34°33'7", Longitude -96°43'4"
- 9) Evaporation
  - a. Calculated (Estimated)
    - i. The amount of water lost to evaporation will be calculated using pan evaporation data obtained from the Fittstown Mesonet Station and converting it to a lake evaporation using a coefficient of 0.7. The Mesonet station is located approximately 7 miles to the SE.
      - 1. Latitude 34°33'7", Longitude -96°43'4"

**Element 8 (Groundwater Monitoring):**

A total of two groundwater observation wells will be utilized for the purposes of monitoring the groundwater levels and any changes or impacts to those groundwater tables as a result of the mining operations. The wells that are proposed to be used for this mine location are existing observation wells that are currently in use in conjunction with an existing exempt mine location. The wells are located south and southeast of the proposed mine location in the hydrological down-gradient area of the proposed mine site. The location of the observation wells to be used are identified and can be seen on in **Figure 1** (Page 8) and **Figure 2** (Page 9).

As required, a well logger will be used on all groundwater wells allowing for the water level in each well to be measured hourly and recorded on a data logger.

Observation wells:

- 1) Kite Tract MW-4
  - a. Depth – 192+ Feet
  - b. Latitude 34 37 5.7, Longitude -96 48 37.8
- 2) Byrd Tract MW-2
  - a. Depth – 75 Feet
  - b. Latitude 34 36 57.3, Longitude -96 48 17.6

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At this time, it is not anticipated that any stream gages will be required to be installed on the mine property. As such there are no plans to install or use a groundwater observation well adjacent to a mine site stream gage.



### Element 9 (Other Onsite Monitoring):

At this time there is no other anticipated onsite monitoring that will occur other than what has already been stated in this management plan.

### Element 10 (Quality Assurance Plan):

All equipment used for the purposes of this plan (pumps, meters, gauges, etc.) will be maintained and calibrated per the manufacturer's specifications and recommended schedule. In addition, all equipment will be checked daily to ensure it is functioning properly and, in the manner, intended. In the event of equipment malfunction, every effort will be made to fix or replace the equipment as soon as possible. During such time, proper and accurate estimates will be made using the most effective and accurate means possible.

All information and data collected will be evaluated using proper engineering and scientific practices to ensure its reliability and accuracy. In addition, all data generated as a result of calculations and estimates will be done so in methods considered valid and accepted by the engineering and scientific community.

### Element 11 (Reporting & Data):

Quarterly and annual reports related to the consumptive use of the pit water will be filed with the OWRB as required per rule. Each report will indicate the total amount of pit water consumed, as well as, any and all data required to support the calculations. As required, each report will contain, at a minimum, the data and information listed in elements 6b (if utilized), 7, and 8. All quarterly reports will be submitted to the OWRB no later than the last day of the quarter following the quarter covered by the report. All annual reports will be submitted to the OWRB no later than the last day of the following 1<sup>st</sup> quarter.

Any modifications to the management plan or any aspect of the management plan will also be submitted before any such modifications are implemented at the mine site. In the event that implementation occurs before the modifications are submitted to the OWRB for approval, they will then be submitted at the first available opportunity. It is understood that any and all modifications to the management plan or any aspect of the management plan are subject to final approval by the OWRB.

As required by rule all data related to this management plan and determination of use and/or disposition of pit water shall be stored in a format readily readable by most common computer programs. In addition, all data will be stored and available for inspection by the OWRB while the mine is in operation and for a period of 5 years after the mine is closed in a format approved by the OWRB.

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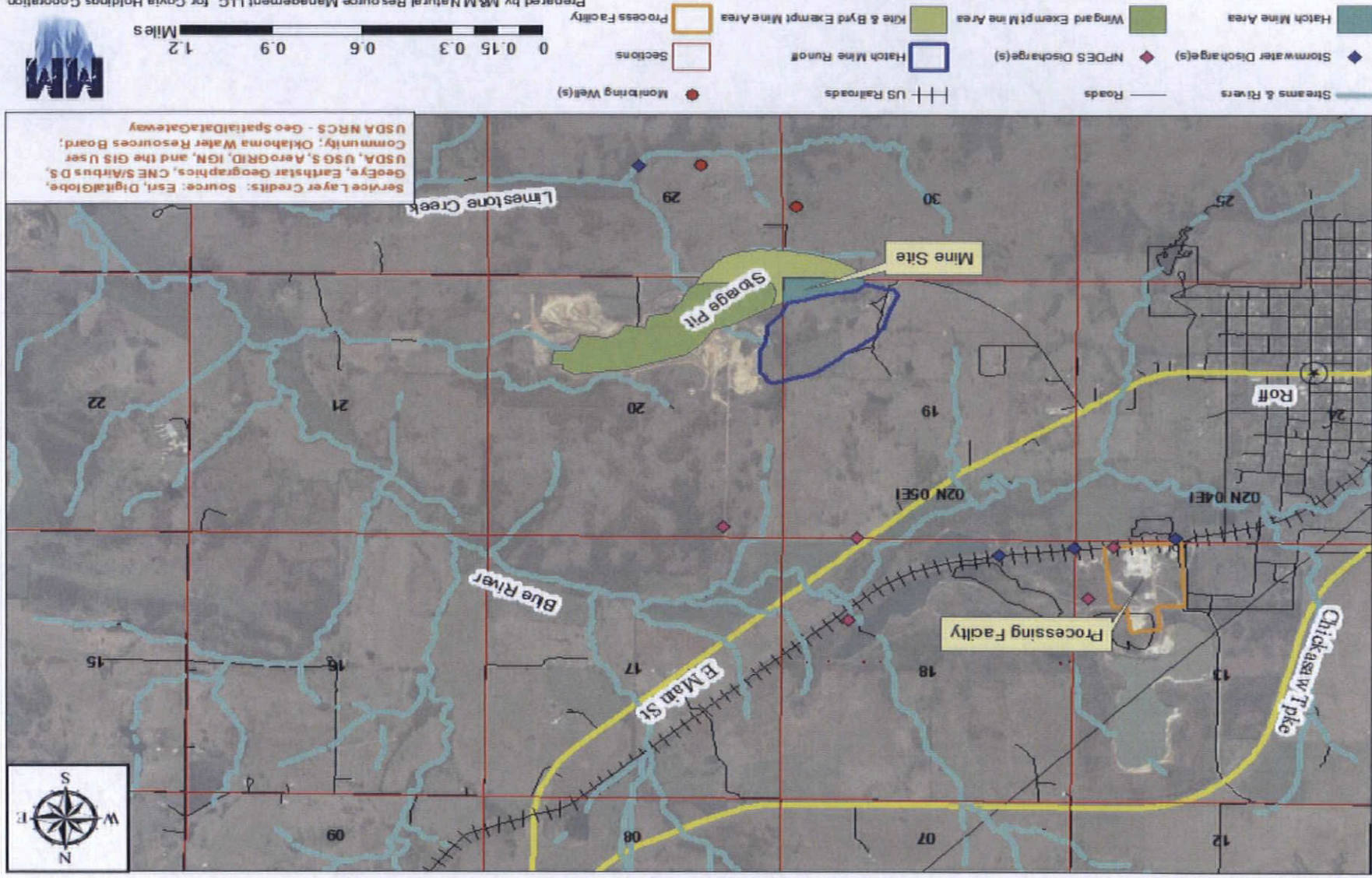


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Figure 1 - Facility Map

# Hatch Mine Site - Covia Holdings Coporation - Pontotoc County Facility Map







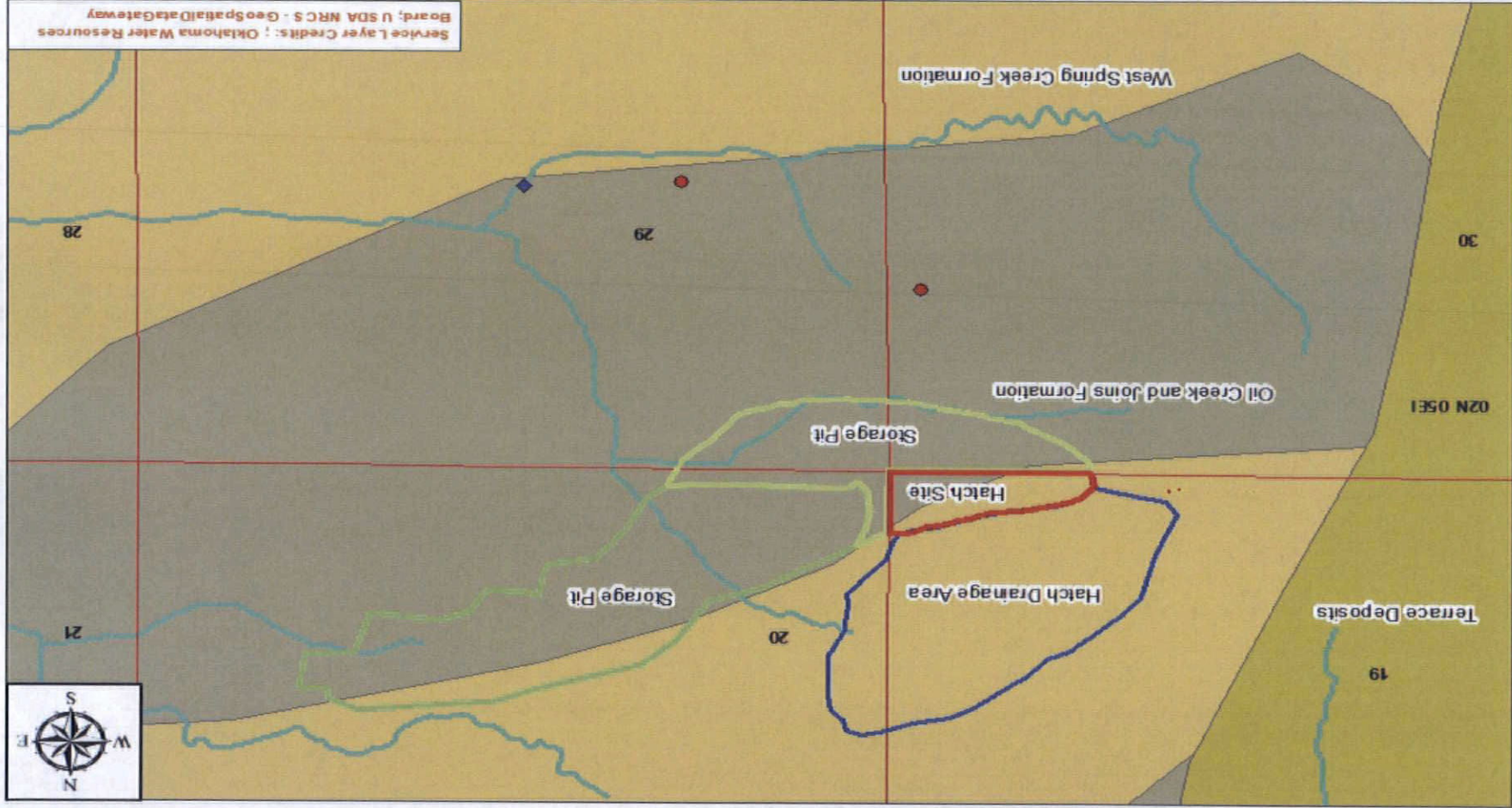


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# Hatch Mine Site - Covia Holdings Coporation - Pontotoc County Geology Map

Figure 3 - Geology Map



Service Layer Credits: Oklahoma Water Resources Board; U SDA NRCS - GeospatialDataGateway



Prepared by M&M Natural Resource Management LLC for Covia Holdings Coporation



Figure 4 – Water Budget Flowchart

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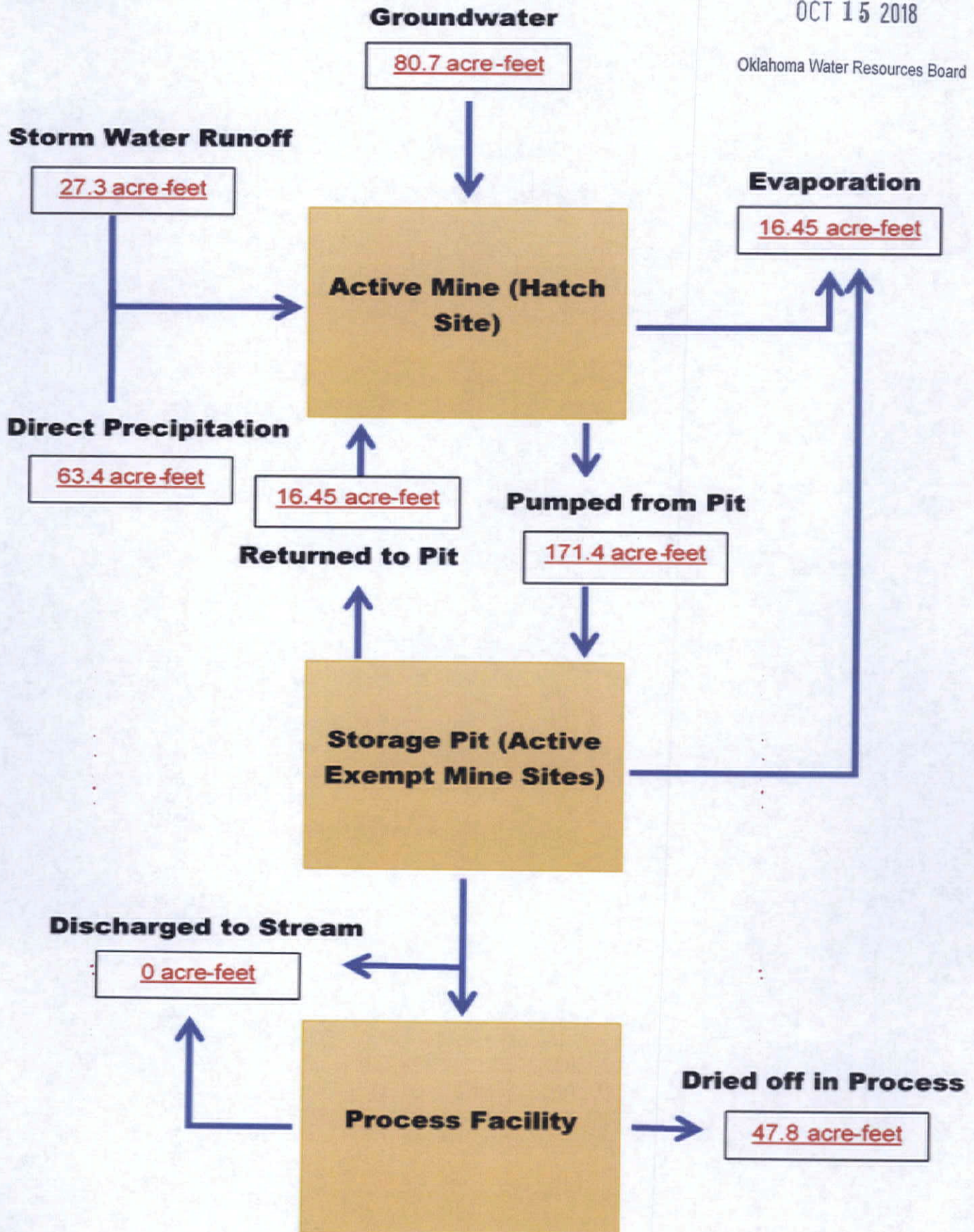




Table 1 – Estimated Consumptive Use Report

Covia - Pit Water Consumptive Use Report -Hatch Mine - Non-Exempt		Oklahoma Water Resources Board
Estimated Annual Initial Report		Acre-Feet
<b>PIT GROUNDWATER VOLUME REMOVED FROM PIT(S)</b>		
1	Total volume of water pumped from the producing mine pit(s)	171.40
2	Volume of precipitation that falls onto the surface of water in the producing mining pit(s)	63.40
3	Portion of total precipitation that flows over the land surface that drains into the mine pit water	27.30
4	Other non-pit waters pumped from the producing mine pit	0.00
5		
6	<b>Total Non-Pit Water (Add lines 2 through 4)</b>	<b>90.70</b>
	<b>Total Pit Groundwater Volume Removed from Pit(s) (Line 1 minus Line 5)</b>	<b>80.70</b>
<b>DEFINED ELEMENTS OF CONSUMPTIVE USE</b>		
7	Volume of pit groundwater that is driven off (by drying) the mined material transported off the mine site	47.80
8	Volume of pit groundwater that is carried away with the mined material transported off the mining site (shipped)	0.00
9	Volume of pit groundwater that evaporates from the producing mine pit, process water ponds, and lined ponds (Excluding structures used for augmentation)	16.45
10	Volume of pit groundwater that is used for other beneficial uses off the mine site	0.00
11	<b>Total Defined Elements of Consumptive Use of Pit Groundwater (Add Lines 7 through 10)</b>	<b>64.25</b>
12	<b>Remaining Non-Defined (Other) Consumptive Use (Line 6 minus Line 11)</b>	<b>16.45</b>
<b>NON-CONSUMPTIVE LOSSES &amp; CREDITS</b>		
<b>Groundwater Augmentation</b>		<b>Credits</b>
13	Volume of pit groundwater returned to the groundwater basin or subbasin, pursuant to a Management Plan	
<b>Stream Augmentation</b>		<b>Non-Consumptive Losses</b>
14	Volume of pit groundwater discharged to a definite stream, during flow conditions that are less than or equal to 50% exceedance, pursuant to a Management Plan	
15	<b>Precipitation &amp; Run-off</b> Volume of precipitation and surface run-off into a recharge pit or holding pond used for augmentation	0.00
16	<b>Recycled Pit Groundwater</b> Volume of pit groundwater returned to a mine pit or holding basin (not included on lines 7 through 10)	16.45
17	<b>Other Non-Consumptive Losses</b> Including pit groundwater returned to the land surface from which surface runoff flows into a mine pit, and other losses (not included in lines 7 through 10)	0.00
18	<b>Total Non-Consumptive Losses &amp; Credits (Add lines 13 through 17)</b>	<b>16.45</b>
<b>NON-DEFINED (OTHER) CONSUMPTIVE USES</b>		
19	<b>Total Adjusted Non-Defined (Other) Consumptive Use (Line 12 minus Line 18)</b>	<b>0.00</b>
<b>TOTAL PIT WATER CONSUMPTIVE USE</b>		
20	<b>Total Net Reported Consumptive Use (Line 11 plus Line 19)</b>	<b>64.25</b>
<b>MINE EQUAL PROPORTIONATE SHARE (MEPS)</b>		
21	<b>Acre-Feet Permitted (Groundwater Permit(s) #2018-524)</b>	<b>211.10</b>



# Attachment 1 – Stream Gage #07332390 Water-Year Summary 2017



USGS Water-Year Summary 2017

## 07332390 BLUE RIVER NEAR CONNERVILLE, OK

**LOCATION** - Lat 34°23'00", long 96°36'01" referenced to North American Datum of 1927, in SW 1/4 SW 1/4 NW 1/4 sec.17, T.2 S., R.7 E., Johnston County, OK, Hydrologic Unit 11140102, on left bank, 1.6 mi downstream from Diamond Spring Branch, 2.16 mi upstream from State Highway 7, 4.0 mi southeast of Connerville, and at mile 99.9.  
**DRAINAGE AREA** - 162 mi<sup>2</sup>. from automated delineation using 10-meter National Elevation Dataset digital elevation model data dated 10/01/2006 and Watershed Boundary Dataset dated 10/01/2006, using Albers Equal-Area Projection, North American Datum 1983.

### SURFACE-WATER RECORDS

**PERIOD OF RECORD** - October 1976 to September 1979, October 2003 to current year.

**GAGE** - Water-stage recorder. Datum of gage is 891.75 ft above NGVD of 1929. Prior to Oct. 1, 2004, published as 896.75 ft above NGVD of 1929.

**REMARKS** - 10/01/2013 - 09/30/2014: records fair. 10/01/2014 - 09/30/2015: records fair. 10/01/2015 - 09/30/2016: records good. 10/01/2016 - 09/30/2017: records good.

**EXTREMES OUTSIDE PERIOD OF RECORD** - Flood of Oct. 8, 1970 reached a stage of approximately 18 feet from approximate point on propane tank pointed out by resident, who has lived at the site since 1969. This flood was the peak of record (1965-1975) at Milburn (35,100 cu ft/s). The 1970 flood was highest since sometime in the 1920's according to a local resident.

**EXTREMES FOR PERIOD OF RECORD** - Maximum discharge for period of record, 12,300 ft<sup>3</sup>/s, gage height 15.87 ft. occurred on May 20, 2017.

U.S. Department of the Interior

U.S. Geological Survey

Suggested citation: U.S. Geological Survey, 2018, National Water Information System data available on

the World Wide Web (USGS Water Data for the Nation), accessed [June 13, 2018], [https://nwis.waterdata.usgs.gov/nwis/wys\\_rpt?dv\\_ts\\_ids=&111797&adr\\_begin\\_date=2016-10-01&adr\\_end\\_date=2017-09-30&site\\_no=07332390&agency\\_cd=USGS](https://nwis.waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=&111797&adr_begin_date=2016-10-01&adr_end_date=2017-09-30&site_no=07332390&agency_cd=USGS)

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Water-Data Report 2017

07332390 BLUE RIVER NEAR CONNERVILLE, OK -- Continued

DISCHARGE, CUBIC FEET PER SECOND  
 YEAR 2016-10-01 to 2017-09-30  
 DAILY MEAN VALUES  
 [e, Value has been estimated.]

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Day	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017	Jul 2017	Aug 2017	Sep 2017
1	51.0	45.8	43.8	e43.8	55.2	67.5	46.5	48.0	125	83.5	103	80.3
2	48.9	46.1	43.8	e46.7	52.2	63.4	50.4	46.7	177	226	105	78.8
3	49.1	48.7	47.4	e44.6	51.6	58.9	48.4	47.1	140	7,300	102	77.5
4	49.6	46.1	48.7	e43.4	52.0	57.5	53.6	46.1	161	2,260	98.1	72.5
5	49.5	46.0	46.7	43.2	53.6	57.7	46.8	45.3	131	1,520	96.0	71.4
6	47.7	46.3	45.8	43.6	52.8	57.8	45.6	45.3	120	496	106	69.7
7	60.3	48.7	45.2	42.5	52.3	56.9	45.6	44.6	115	259	110	69.0
8	54.7	89.8	44.1	42.5	50.7	e54.1	44.0	43.8	108	200	99.2	68.7
9	52.2	48.5	44.3	43.2	49.8	e54.6	44.1	44.0	106	348	95.8	68.2
10	50.5	45.7	44.7	43.8	50.2	54.3	44.6	46.9	104	218	94.8	66.9
11	49.0	45.4	45.5	43.2	50.3	53.8	45.3	46.9	105	181	99.6	65.8
12	48.3	43.9	45.9	43.1	49.4	53.7	43.1	44.2	102	163	97.1	64.9
13	48.1	45.3	45.2	44.0	49.0	55.0	43.2	43.8	100	151	98.6	64.9
14	48.4	45.7	45.2	49.5	155	53.8	42.7	43.1	98.7	144	102	64.2
15	48.1	44.2	44.3	59.8	244	52.5	43.0	43.0	96.7	142	100	63.0
16	47.0	43.9	45.2	655	108	54.9	41.7	42.8	94.6	139	98.1	63.1
17	46.9	43.6	44.7	130	80.7	55.9	47.0	45.3	94.5	133	124	65.8
18	46.8	43.5	43.4	82.5	72.8	54.5	43.9	44.8	93.3	130	107	71.9
19	46.6	43.6	43.6	72.2	68.3	53.1	42.3	840	96.6	128	97.0	66.9
20	105	43.9	43.8	66.2	72.5	51.5	41.7	6,830	93.3	125	90.9	66.9
21	84.9	44.0	44.5	62.7	115	50.3	42.0	263	90.8	126	87.6	65.4
22	54.8	45.5	44.2	60.0	78.1	49.5	45.3	156	88.2	121	86.9	62.5
23	52.5	46.5	45.3	57.0	72.0	49.1	41.7	155	86.8	129	160	60.3
24	50.5	44.7	45.3	56.9	69.0	48.8	41.0	136	85.4	129	106	59.4
25	49.8	44.2	45.6	58.3	64.8	48.1	41.1	117	84.1	111	91.6	58.0
26	49.9	44.4	44.9	56.4	64.0	50.4	52.8	109	82.2	107	88.2	58.1
27	47.8	45.1	43.8	54.7	64.1	48.8	45.0	178	81.3	105	85.8	60.5
28	46.0	49.0	43.8	54.3	65.9	47.9	42.4	1,100	80.5	103	85.3	63.6
29	46.2	45.3	43.1	54.1		51.4	71.9	178	83.0	104	85.1	105
30	46.8	44.0	e43.5	53.6		47.4	92.9	132	82.5	104	85.5	73.6
31	46.3		e43.8	53.6		47.1		119		102	83.3	
Total	1,623	1,407	1,389	2,304	2,063	1,660	1,419	11,130	3,106	15,590	3,070	2,047
Mean	52.4	46.9	44.8	74.3	73.7	53.6	47.3	359	104	503	99.0	68.2
Max	105	89.8	48.7	655	244	67.5	92.9	6830	177	7300	160	105
Min	46.0	43.5	43.1	42.5	49.0	47.1	41.0	42.8	80.5	83.5	83.3	58.0
Ac-ft 3,220	2,792	2,755	4,571	4,092	3,293	2,816	22,070	6,162	30,919	6,088	4,060	



STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1977 - 2017, BY WATER YEAR  
(WY)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	76.5	74.0	90.9	80.8	68.4	103	91.7	214	188	158	58.5	48.7
Max	594	361	726	376	206	281	290	1,522	874	747	156	102
(WY)	(2010)	(2016)	(2016)	(2005)	(2010)	(2016)	(2016)	(2015)	(2015)	(2015)	(2015)	(2015)
Min	26.7	27.8	28.7	31.6	31.1	34.3	33.4	43.3	38.5	33.2	29.1	26.9
(WY)	(2015)	(2015)	(2015)	(2009)	(2006)	(2009)	(2013)	(2012)	(2011)	(2011)	(2006)	(2006)

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07332390 BLUE RIVER NEAR CONNERVILLE, OK -- Continued

SUMMARY STATISTICS

	Water Year 2017	Water Years 1977 - 2017	
Annual total	46,800		
Annual mean	128.2	107.6	
Highest annual mean		309.8	2015
Lowest annual mean		40.3	2011
Highest daily mean	7,300	Jul 03	9,200 Jun 18, 2015
Lowest daily mean	41.0	Apr 24	21.4 Oct 22, 2006
Annual 7-day minimum	42.2	Apr 19	22.4 Oct 18, 2006
Maximum peak flow	12,300	May 20	12,600 Jul 08, 2015
Maximum peak stage	15.87	May 20	16.02 Jul 08, 2015
Annual runoff (cfs)	0.792		0.646
Annual runoff (inches)	10.7		8.78
10 percent exceeds	129.4		159.0
50 percent exceeds	54.6		47.1
90 percent exceeds	43.8		31.5

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