The Use of Water in Ohio’s Oil & Gas Boom
WMAO Luncheon
February 10, 2016
Columbus

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John Watkins, P.E., C.F.M. Conservation Engineer
Responsible stewards dedicated to providing the benefits of flood reduction, conservation and recreational opportunities in the Muskingum River Watershed.
Multi-Purpose Reservoirs

- Flood Control
- Recreation
  - Boating
  - Fishing
  - Swimming
- Water Supply
Presentation Overview

- **Historical Perspective: O&G and MWCD**
- O&G Horizontal Fracturing
- Flood Control/Reservoirs/Recreation
- O&G Need for Water
- Questions
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MWCD Oil and Gas Program

The MWCD oil and gas program began in the 1930s with the purchase of properties with existing oil and gas leases and wells on the property.

Some property owners kept their mineral rights, others transferred those rights to MWCD

Historical Oil and Gas Lease Map- Seneca
Example of Property with Pre-Existing Oil and Gas Lease

Property Purchased for Bolivar Project From Emery Dayton in 1938

- Existing Lease with Natural Gas of West Virginia signed in 1922
- The minerals were transferred to the District with the property purchase.
- The District received payments until the well was plugged in 1959.
By 1939 the MWCD was actively leasing additional acreage

- January 5, 1939 the District executed it’s 1st Oil and Gas Lease to George Jewell

- April 19, 1939 the District executed it’s 2nd Oil and Gas Lease to George Jewell on 114.17 acres for $20.50. The lease had added protections, For Example: The Chief Engineer must approve location of all wells ...
The pattern was set to use oil and gas revenues to help support the operations of the MWCD.

1943 Cash Receipts from Oil and Gas Totaled $13,684.34

9.43% of the total Cash Receipts for the District that year.

1933-1942 Total Receipts from Oil and Gas Totaled $102,622.94
Overview

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Seneca Lake
Traditional MWCD Vertical Wells in the Seneca Region
Drilling Comparison

Traditional Wells  Horizontal Drilling
First Indication of profitable shale production for the MWCD

- Prior to the Utica shale, royalty revenue was generated from approximately 277 wells, with 120 of those wells located on MWCD property. Typical bonus payment was $10/acre

- June 2008 - Patriot Energy Partners offered $12/Ac. for all areas east of I-77, approximately 30,000 Ac. for Marcellus Shale development

- MWCD Initiated a two year study. Was geology in our favor? If so, how should we proceed?
An Example of the many hydrocarbon maps

Reported Utica Test Results
(54 Total Wells)

Source: Company reports and Imperial Capital, LLC estimates as of 6/2/2013
Offers For Utica Shale
(up front bonus)

- May 7, 2010 – $75/Ac. offer for 520 acres at Leesville
- July 20, 2010 – $250 / Ac. for 100 acres at Tappan
- August 2, 2010 - $400 / Ac. for acreage at Tappan
- August 19, 2010 $750/Ac. for 7,292 acres at Tappan ($5.5 million)
- September 2010 $1,000/Ac. at Tappan
- November 2010 $1,500/Ac. at Tappan
Offers For Utica Shale (up front bonus)

• May 2010 $75/Ac. offer for 520 acres at Leesville
• November 2010 $1,500/Ac. at Tappan

Actual Leases For Utica Shale (up front bonus)

• Clendening Gulfport 1, $2,400 acre
   Gulfport 2, $5,000 acre
• Leesville Chesapeake $5,800 acre
• Seneca Antero $6,800 acre
• Piedmont Antero $15,000 acre
The MWCD moved forward leasing available mineral acreage in measured steps.
Clendening
Utica Lease = 6527.8 Total Acres Leased to Gulfport Energy
Leesville - Chesapeake
Utica Lease = 3,682.3535 Total Acreage Paid
3,709.2330 Total Leased with approx. 20 acres not verified
Seneca
Utica Lease = 7140.4141 Total Acres Leased to Antero Resources
140 acres of deep rights assigned to Antero through Lease 330
Piedmont
Utica Lease = 6,498.76 Total Acres Leased  Antero Resources
1.3 Acres Leased to Gulfport Energy
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Multi-Purpose Reservoirs

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- Water Supply
Dust Bowl Era
Led to MWCD Reservoirs
Flood Control

• 14 MWCD Flood Control reservoirs

• All 14 dams provide flood protection
  o 4 dry dams (no permanent pool)
  o 10 dams with a permanent pool
  o 9 of the 10 dams with permanent pools may be capable of providing water supply for various uses
MWCD Dams with Lakes (not including Beach City)

- Atwood
- Charles Mill
- Clendening
- Leesville
- Piedmont
- Pleasant Hill
- Seneca
- Tappan
- Wills Creek
## Conservation Pool / Flood Storage

<table>
<thead>
<tr>
<th>Name</th>
<th>Conservation Pool (acre feet)</th>
<th>Flood Capacity* (acre feet)</th>
<th>Additional** Drawdown Capacity (acre feet)</th>
<th>Total Volume*** (acre feet)</th>
<th>Minimum Flows (CFS)</th>
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*Between Conservation Pool and Spillway Crest elevations

*** = Conservation Pool + Flood Storage

** Subtracted from Conservation Pool

**** - Non MWCD reservoir
Water Supply

How Much Water is available?

USGS conducted two studies of availability of water at:

1. Atwood, Clendening and Leesville
   
   Report can be found at:
   

2. Charles Mill, Piedmont, Pleasant Hill, Seneca, Tappan, and Wills Creek
   
   Report can be found at:
   
USGS Water Supply Studies

• Statistical Analysis
  – Precipitation data
  – Operational capabilities of each dam
  – Volume needed for flood prevention
  – Minimum volumes of water needed for recreation, stream flow
  – Potential Pumping rates
## Reservoir Data

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<tr>
<th>Reservoir</th>
<th>Summer Pool</th>
<th>Gallons/Inch Normal Pool</th>
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# Results of USGS Water Studies

Table 24. Monthly statistics of Wills Creek Lake, Ohio, daily mean flow-by amounts for indicated pumping rates and target minimum flow-by amounts, expressed as a percentage of corresponding statistic based on observed outflows.—Continued

[8³, cubic foot per second; Mgal/d, million gallons per day; color scale is gradient from maximum value, in green, to minimum value, in red]

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<th>Monthly mean flow-by amounts expressed as a percentage of observed outflow statistics, for indicated months and pumping rates</th>
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Results: Seasonality
Results of USGS Water Studies

Basic Conclusions

- Water is statistically available at all lakes based upon seasonal and yearly precipitation.

- Amounts vary from lake to lake and are dependent upon operation of each lake for flood capacity, recreation, and maintaining minimum flows.
Overview

- Historical Perspective: O&G and MWCD
- O&G Horizontal Fracturing
- Flood Control/Reservoirs/Recreation
- **O&G Need for Water**
- Questions
**Water Needs**

- Well Laterals now approaching >10,000 feet
- Anywhere from 5 - 10 million gallons may be needed to frack one well using 500 foot frack stages
- Single pad could use 40 – 80 million gallons
Gulfport Energy Well Pad at Fort Steuben on Clendening
Water Sources

- Local resources close to well pads
  - Farmers ponds
  - Rivers/streams
  - Muni water
  - Groundwater

- Trucking not preferred ($’s and risk)
  (1 well = 2000 – 3000 truckloads one way)
MWCD’s Eastern Reservoirs

- Atwood
- Leesville
- Clendening
- Tappan
- Pidemont
- Seneca
Water Supply from Reservoirs

Long Term and Short Term agreements

• Ohio Revised Code (ORC) 6101.24 and ORC 6101.53

• **Long-term agreements:** Approval of recommended sales of water needed by MWCD Board of Directors; review of rates to be conducted by Conservancy Court

• **Temporary (short-term agreements):** Approval needed by MWCD Board of Directors only.
Water Supply from Reservoirs

**Long Term agreements**

- ORC 6101.24

- **Long-term agreements:** Approval of recommended sales of water needed by MWCD Board of Directors; review of rates to be conducted by Conservancy Court

- 3 agreements:
  
  A. Village of Cadiz – Water supply from Tappan Lake for municipal service

  B. City of Cambridge – Seneca Lake serves as an emergency backup location for municipal water service

  C. Carroll County – Water supply from Atwood Lake for Atwood Lake Resort
Short-term agreements: Approval of recommended sales of water needed by MWCD Board of Directors; Policy on short term water sales approved by MWCD Board in 2013.

- Agreements are for 3 month period
- No withdrawals during February – April
  (except when excess water is available)

- 24 short term agreements since 2012
- Focused on sales for the development of oil and gas wells
Water Supply from Reservoirs

MWCD Short Term Water Supply Policy

ORC 6101.53

• Balances Recreational Use and Water Supply
  ➢ Public Drinking Water supply (current or future) has first priority

• Two categories:
  A. Construction and Other Small Withdrawals
     Example: Temporary concrete plant for a major public highway project
  B. Mineral Production and Other Large Consumptive Uses
     Example: Raw water used in the production of unconventional oil and gas formations.
Siting of Withdrawal Location
MWCD Policy No. 5091:2

• Recreational boating or other outdoor recreational activities are not to be negatively impacted;

• Present or future drinking water allocations are not to be disrupted;

• Reservoir’s flood storage capacity should always be protected;

• Minimum downstream environmental flows must not be impacted;

• Tanker-truck delivery of raw water should be eliminated to the greatest extent possible;
Siting of Withdrawal Location
MWCD Policy No. 5091:2

- Multiple engineering components shall be used to prevent backflow of fresh water as well as noise attenuation;
- Flow meter calibration should be certified;
- Invasive species transfer prevention is required;
- Withdrawal equipment and associated distribution infrastructure, if previously used, must only have been used for fresh-water purposes.
- Supply line routes should be the least disruptive as possible;
Proposed route of temporary waterline
Water Lines
Withdrawal at different water levels
Water Supply Pump Site
Check Valve
Conotton Creek near Amsterdam, Ohio
Inches of water withdrawn from 4 lakes in 2015 (Short Term agreements)
## Number of Truckloads of Water avoided by direct water withdrawal from 4 MWCD lakes in 2015

<table>
<thead>
<tr>
<th>Lake</th>
<th>Volume pumped (gallons) 2015</th>
<th>Equivalent Number of Truckloads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clendening</td>
<td>14,398,104</td>
<td>4,276</td>
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<tr>
<td>Leesville</td>
<td>41,667,780</td>
<td>12,376</td>
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<td>Seneca</td>
<td>221,133,016</td>
<td>65,666</td>
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<td>Tappan</td>
<td>85,431,310</td>
<td>24,630</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>362,630,210</strong></td>
<td><strong>106,948</strong></td>
</tr>
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</table>
Number of Truckloads of Water avoided by direct water withdrawal from MWCD lakes 2012 - 2015

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume pumped (gallons) 2012 - 2015</th>
<th>Equivalent Number of Truckloads</th>
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<tr>
<td>2012</td>
<td>15,093,830</td>
<td>4,573</td>
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<td>2013</td>
<td>68,880,009</td>
<td>20,872</td>
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<td>2014</td>
<td>157,643,705</td>
<td>47,770</td>
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<tr>
<td>2015</td>
<td>362,630,210</td>
<td>106,948</td>
</tr>
<tr>
<td>Total</td>
<td>604,247,754</td>
<td>183,105</td>
</tr>
</tbody>
</table>
Overview

• Historical Perspective: O&G and MWCD
• Flood Control/Reservoirs/Recreation
• O&G Horizontal Fracturing
• O&G Need for Water
• Questions
MWCD Water Supply

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Conservation of Water Resources