



Missouri Department of Natural Resources

WORKSHOP ANNOUNCEMENT

WASTEWATER ENGINEERING – REGULATIONS CHANGES AND CONSTRUCTION PERMIT PROCESS

Are you designing a new or modified wastewater treatment system?

Do you have questions about the new rules and regulations regarding the permitting process and effluent limitations?

How will the proposed 2013 EPA Water Quality Criteria for Ammonia affect your wastewater treatment project?

No-Discharge? What does this require?

Take this opportunity to learn about wastewater construction permitting and to discuss your particular concerns.

March 18, 2014

Kansas City Regional Office
Large Conference Room
500 NE Colbern Road
Lee's Summit, MO 64086

March 19, 2014

Springfield Conservation
Nature Center - Auditorium
4600 South Chrisman Avenue
Springfield, MO 65804

March 25, 2014

Elm Street Conference Center
Bennett Springs Conference Room
1730 East Elm Street
Jefferson City, MO 65101

March 26, 2014

Alberici Constructors
Energy Zone
8800 Page Avenue
St. Louis, MO 63114

March 27, 2014

Conservation Nature Center
Auditorium
2289 County Park Drive
Cape Girardeau, MO 63701

Suggested audience:
Engineering Consultants

Professional Engineers –
Five PDHs are available.

The Water Protection Program has developed a Web page that provides information about wastewater construction permitting. Visit:

<http://www.dnr.mo.gov/env/wpp/permits/ww-construction-permitting.htm>.

Limited seating – Register today to reserve a seat. Walk-ins may be restricted or denied due to room capacity.

REGISTRATION

Please register before February 14, 2014 to confirm seating. These sessions will have an \$11 fee at the door for lunch and refreshments. Details of sandwich type lunch will be provided by March 10. Exact cash is requested.

To attend one of these sessions, please notify Keith Forck via e-mail keith.forck@dnr.mo.gov, fax at (573) 522-9920, or phone at (573) 526-4232. Please provide the following information:

Name _____ Email Address _____

Company/Department _____ Phone Number _____

Address _____ City _____ State _____ ZIP _____

Circle Choices: Session Location and Date: KC – Waiting List – 3/18 Springfield - 3/19
JC – 3/25 St. L – 3/26 Cape Girardeau – 3/27 Lunch Preference: Beef Turkey Ham
Vegetarian No Lunch

AGENDA:

8:45 a.m.

Registration

9:00 a.m.

Introduction

9:10 a.m.

**Water Quality and
Antidegradation Review
Assistance**

9:50 a.m.

**Facility Plan/Engineering
Report Reviews**

10:20 a.m. - **Break**

10:30 a.m.

**10 CSR 20-6.010 –
Construction Permits**

11:00 a.m.

**Other 6.010 – Closure Plans,
Operating Permits,
Continuing Authorities**

11:30 a.m. - **Lunch**

12:15 p.m.

Missouri Geological Survey

1:15 p.m.

**No-Discharge – Land
Application, Sub-Surface
Irrigation, and 3000 Gallon
per Day Exemption**

2:00 p.m. - **Break**

2:10 p.m.

EPA Ammonia Criteria

2:50 p.m.

**Ammonia Treatment and
Other Experiences
Roundtable Discussion**

3:30 p.m. – **Adjourn**

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Antidegradation Introduction

Cailie McKinney
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(573) 526-1289

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History and Rule Adoption

- Statute and Rules: 25 Years
- Oct. 7, 2003 *Missouri Coalition for the Environment vs. Leavitt* (Case No.03-4217-CV-C-NKL W.D. Mo.)
- Missouri Clean Water Commission adopted the "Missouri Antidegradation Rule and Implementation Procedure" (AIP) with revisions to the April 20, 2007 version based on comments received
- AIP Effective August 30, 2008
- Minor Revision May 2, 2012

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Who is Affected?

- State Operating Permits & Construction Permit applications, received on or after the AIP effective date, for discharges that are

New or Expanded!

“Approved degradation”

- is the *justified* use of a water’s ability to assimilate pollutants without adversely impacting beneficial uses of the water



Tiers of Water Quality

- **Tier 1:** Water is At, Near, or Violating the WQS – Must meet WQS or TMDL.
- **Tier 2:** Water Quality is Better than WQS (or default for no EWQ), and Degradation may be allowed if justified.
- **Tier 3:** Outstanding National & State Resource Waters – No degradation.



Antidegradation Review Submittal

- Water Quality Review Assistance/ Antidegradation Review Request (WQRA) Form (Detailed Instructions on Form)
 - + Attachments
- Antidegradation Review Report ([Example Report Outline](#))
- Map showing location of each outfall
- For gaining streams: Dissolved Oxygen modeling
- Check for Rare or Endangered Species
 - <http://newmdcgis.mdc.mo.gov/EnvReview/Default.aspx>
- [Geohydrologic Evaluation](#) from Geological Survey Program if applicable



DO Modeling - For discharges to all gaining streams

- **Streeter Phelps:** www.ecy.wa.gov/programs/eap/pwspread/pwspread.html
use PWSREAD.XLS and the dosag2 sheet only
- **OR**
- **Qual2K/Qual2E (Q2K/Q2E):** www.epa.gov/athens/wqgsc/index.html
Note: All Q2K/Q2E studies must have department-approved QAPPs
- DO modeling and BOD effluent limit development guidance: www.dnr.mo.gov/env/wpp/permits/DO_Modeling_Administrative_Guidance_Dec_09.pdf
- DNR may provide more specific procedures & suggested model inputs upon request.



Antidegradation Summary Forms

Submit appropriate form(s) in addition to WQRA Form:

- Attachment A: Tier 2 – Significant Degradation
- Attachment B: Tier 2 – Minimal Degradation
- Attachment C: Temporary Degradation
- Attachment D: Tier 1 Review

Forms are available at <http://www.dnr.mo.gov/forms/index.html> or <http://www.dnr.mo.gov/env/wpp/permits/antideg-implementation.htm>



Tier One Submittal Includes

- [Attachment D: Tier 1 Review](#)
- Antidegradation Report ([Example Outline](#))
 - Include One of the following :
 - existing receiving water quality data that demonstrates the statistical process (90th% value is significantly more than 95% of the WQS for the Pollutant of Concern (**POC**));
 - an appropriate water quality model; or
 - department Section 303(d) listings or possibly 305(b)

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Tier Two

- 1) Non-Degrading:
 Demonstrate that loading will be **maintained or decreased** for each POC
- 2) Minimally Degrading:
 Demonstrate that the loading will consume **less than 10% of the assimilative capacity** for each POC
- 3) Significantly Degrading:
 Demonstrate or assume degradation with **Alternatives Analysis and Social and Economic Importance Evaluation (SEI)**

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Minimally/Non Degrading Submittal Includes:

- [Attachment B: Tier 2 – Minimal Degradation](#)
- Antidegradation Report ([Example Outline](#))
 - Demonstration of <10% of Facility Assimilative Capacity for each POC
- OR**
- Demonstration of Reduction or Maintenance of POC Mass Loading

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Tier Two Significantly Degrading Submittal Includes:

- [Attachment A: Tier 2 – Significant Degradation](#)
- Antidegradation Report ([Example Outline](#))
 - Alternatives Analysis
 - Socio-Economic Importance (SEI) Demonstration

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Tier Three

- Outstanding National Resource Waters (ONRWs) or Outstanding State Resource Waters (OSRWs) [10 CSR 20-7.031(1)Q.&R.]
- Degradation prohibited
- Temporary degradation may be allowed on a case-by-case basis
- Discharges in watersheds with significant losing streams should contact the Geological Survey Program for dye tracing information

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Temporary Degradation Submittal Includes:

- [Attachment C: Temporary Degradation](#)
- Description of the Nature of the Project:
 1. Length of time during which water quality will be lowered.
 2. Percent change in ambient conditions.
 3. Parameters affected.
 4. Likelihood for long-term water quality benefits to the segment.
 5. Degree to which achieving the applicable water quality standards during the proposed activity maybe at risk.
 6. Potential for any residual long-term influences on existing uses.



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Preliminary WQAR

- Comment Period for Applicant (1 week)
- Once finalized: 30 days for applicant appeal.
- Public notice process typically occurs with Operating Permit.





Future Fees for Antidegradation Reviews

January 1, 2015

\$500	<100,000 gallons per day
\$1,000	≥ 100,000 gallons per day





Antidegradation Review Reporting

WASTEWATER ENGINEERING WORKSHOP

2014

Todd Blanc
Water Protection Program





Overview

- Issues with Submitted Antidegradation Review Reports
 - Alternative Analysis – More often
- Resources for Antidegradation Review Report Writing



Resources

<http://www.dnr.mo.gov/env/wpp/permits/antideg-implementation.htm>

Antidegradation Review Reports Issues



Completeness Issues

1. Not signing the attachment forms
2. Engineer seal on alternative analysis
3. Missing items, if applicable:
 1. Geohydrologic Evaluation-
<http://www.dnr.mo.gov/forms/780-1688-f.pdf>
 2. Natural Heritage Review -
<http://newmdcgis.mdc.mo.gov/EnvReview/Default.aspx>
 3. DO Modeling -
www.dnr.mo.gov/env/wpp/permits/DO_Modeling_Administrative_Guidance_Dec_09.pdf



Completeness Issues:

4. List of pollutants of concern (POCs) and Tier Level
 - Effluent character and regulations at Revised 10 CSR 20-7.015 – Effective 2/28/14.
5. Location and/or receiving stream information
 - Missouri Use Designation Dataset. Interactive GIS layer at: http://dnr.mo.gov/env/wpp/rules/wpp-rule_dev.htm#interactivemapanduserguide



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- See AIP Page 23 - 31

Alternative Analysis Issues



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Alternative Analysis Issues

1. New Technology in practicability analysis or as preferred alternative.

See AIP, Page 24. Says.....

- Must provide performance info.
- May be approved BUT.....



The proposed technology is considered a new technology, and you will need to submit additional data with your application. Please see <http://www.dnr.mo.gov/pubs/pub2453.pdf> on what is required for a new technology

2. Analyze at least **three** practicable treatment options in the Economic Efficiency Analysis.
 - Must meet water quality standards



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Alternative Analysis Issues

3. Economic efficiency analysis needs to provide more efficient options, not just options that *just* meet WQS.

Comment:

"Further discussion in the alternatives evaluation should include the evaluation of alternatives which achieve *greater* pollution reduction than the minimum required by the Water Quality Standards. Is there an alternative, which is both economically efficient and practicable, that is not being considered?"





TIP – Economic Efficiency

- ❑ AIP Page 26, Alternatives must meet minimum controls to protect existing uses.
 - ❑ Base cost of pollution control protects uses.
- ❑ Page 26, “Economic efficiency is ...to optimize the balance between water quality benefits and project costs.”
- ❑ Page 27, Not efficient, if > 1 : 1.20
 - ❑ Non-binding rule of thumb



Economic Efficiency Table--Meets WQS & Poor Efficiency

Parameter	Extended Aeration Treatment Plant	Recirculating Sand Filter	Orenco Advantex Recirculating Fabric Filter
BOD5 (mg/L)	10	15	10
TSS (mg/L)	15	10	10
DO (mg/L) Minimum	5	5	5
Ammonia (mg/L) (average)	1.4	1.4	1.4
E. coli (col/100 mL)	126	126	126
Practicability	Yes	Yes	Yes
Total Present Worth*	\$ 1,386,657	\$ 1,647,151	\$ 1,720,882
Cost Ratio	1:1.00/Base	1:1.19	1:1.24
Economic Efficiency	Efficient	Efficient ??	Not Efficient

* 20 year design life and 5% interest Rate.



Economic Efficiency Table – Not Meet WQS and Shows Efficiency.

Parameter	RSF	Waterloo Biofilter	Intermittent (ISF)	MBR
BOD (mg/L)	6.3	7.4	3.0	2.0
TSS (mg/L)	4.5	5.0	3.0	2.0
Ammonia (mg/L) (average)	10	3.0	0.48	0.5
E. Coli	126	126	126	126
Practical	Yes????	Yes	Yes	Yes
Life Cycle Cost*	\$41,864	\$46,864	\$51,864	\$61,240
Ratio	1:1.00	1:1.12	1:1.23	1:1.46
Economic Efficiency	Base	Yes	No	No

* Life cycle cost at 20 year design life and 4 % interest

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Minimally Degrading Review Issues

- Data collection?

See Implementation Page: "Water Quality Monitoring in Support of Missouri's Antidegradation Rule"

- Missing Tier Determination – See AIP, Appendix 2, Page 41.
 - Resource: Spreadsheet is available.



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Other Reporting Concerns



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Antidegradation Review Approval Letter

*"You may proceed with submittal of an application for an operating permit and antidegradation review public notice, an engineering report, or a complete application for a construction permit. These submittals must reflect the **design flow, facility description, and general treatment components** of this WQAR or this preliminary determination may have to be **revisited**."*





Case Example





10,500 gpd recirculating sand filter closed and replaced

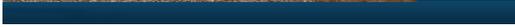


- ✓ Alternative analysis
- ✓ Expansion with more RSFs





Outfall 001 Removal





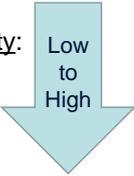
Last Thoughts



Consider the demonstration for your discharge.

Increasing demonstration complexity:

- 1) **Maintain or reduce loading?**
- 2) Minimally degrading with EWQ?
- 3) Alternative analysis?





Antidegradation Review Reporting

WASTEWATER ENGINEERING WORKSHOP

2014

Todd Blanc
Water Protection Program
314-416-2064

Facility Plan/ Engineering Report

Cindy LePage, P.E.

cindy.lepage@dnr.mo.gov

573-751-6618

<http://dnr.mo.gov/env/wpp/permits/ww-construction-permitting.htm>

1

Facility Plan Required for

- WWTF \geq 22,500 gpd
- All that receive funding through the grant and loan programs under 10 CSR 20-4

2

Engineering Report Required for

- Sewers
- Pump Stations
- Force Mains

That require CP

3

Engineering Report Suggested for

- WWTF < 22,500 gpd
 - Submit with CP application and P&S

4

Water Quality Antideg Review

- Done Prior to/or Concurrent with Facility Plan Review

5

Cover Letter

- Request Review for
 - Antideg Review*
 - Facility Plan or Engineering Report
 - Construction Permit*
 - All of the above

*Include application

6

Guidance

- Facility Plan Guidance
– <http://dnr.mo.gov/pubs/PUB2416.pdf>
- Engineering Report Guidance
– <http://dnr.mo.gov/pubs/PUB2415.pdf>

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Report Submittal

- Title Page
- Existing Conditions and Loads
- Proposed Conditions and Loads
- Flood Considerations
- Alternatives Considered
 - Present Worth and User Charge (Facility Plans)
- Recommended Alternative
- Design Criteria

8

Detail Required

- Detail and size of the report depends on the scope of the project
- Enough detail to follow rationale of selected alternative
- Project should be transparent

9

Title Page

- Name of Project
- Owner of System
- Preparer Name, Address, Phone Number,
Fax Number, **Seal and Signature**
- Date of Submittal

10 CSR 20-8.110(4)(A)3.

10

Existing Hydraulic Load

- Permitted Design Flow
or
 - Actual Flow
- Whichever is greater

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Existing BOD and TSS Loading

- Influent Wastewater tests to characterize
the Actual Organic loading rate
 - Actual Peak Month and Peak Day loading rate
is recommended

10 CSR 20-8.110(4)(A)8.D.

12

Flow for New Systems

- Average Daily Flow:
"...shall be designed on the basis of an average daily per capita flow of sewage of not less than 100 gallons per day."
- Peak Flows:
 - In absence of flow measurement data, use...
 $Q = [(18 + \sqrt{P}) / (4 + \sqrt{P})]$
Q = flow in gallons per day
P = population in thousands

10 CSR 20-8.120(5)(A)

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Organic Load for New Systems

- At least 0.17 pounds of BOD5 per capita per day, and
- At least 0.20 pounds of suspended solids per capita per day
 - Unless justified in writing

10 CSR 20-8.120(5)(B)

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Proposed Conditions and Loads

Based on 20 YEAR planning period

"Projections shall be made from
ACTUAL FLOW DATA
to the extent possible"

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Report Submittal

- *Title Page*
- *Existing Conditions and Loads*
- *Proposed Conditions and Loads*
- Flood Considerations
- Alternatives Considered
 - Present Worth and User Charge (Facility Plans)
- Recommended Alternative
- Design Criteria

Flood Considerations

- Treatment works structures, electrical and mechanical equipment shall be
 - Protected from Physical Damage by the 100 year flood...and fully operational
 - Accessible during the 25 year flood

10 CSR 20-8.140(3)(A)

Project Alternatives

- [May Be Done as part of the Antideg](#)
- Consider several options
- Consider no-discharge system
- Estimate Present Worth
- Estimate User Charge (Facility Plans)

Engineering Design Criteria

- Engineering Criteria in Design
 - 10 CSR 20-8 – Design Guides
 - [Deviations from Chapter 8 are allowed when adequate technical justification is provided](#)
- Identify Assumptions

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Recommended Project

- Total Project Cost
- Estimated O&M Costs
- Estimated User Charge
- Plant Design Average and Peak Flows
- Design Organic Loading
- For Upgrades, Indicate What Units are to be Upgraded
- Average and Peak Hourly Flow for Pumps Stations and Sewers
- Engineering Criteria Used for Preliminary Sizing of Facilities

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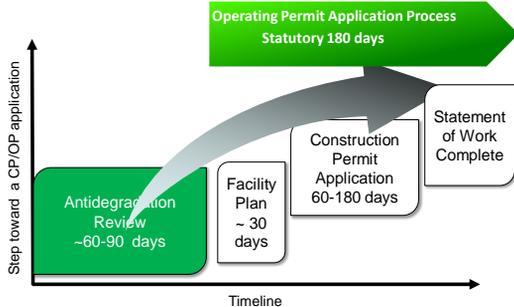
21

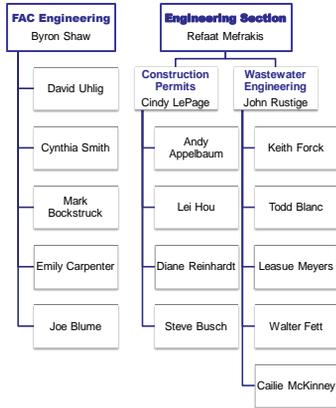
Construction Permit Process

John Rustige, P.E.

1

- Revised Statutes of Missouri (RSMo)
 - 644.051 RSMo
- State Regulations (CSR)
 - 10 CSR 20-6.010 Construction and Operating Permits
 - 10 CSR 20-8.XXX Design Guides
- Forms
 - <http://dnr.mo.gov/forms/index.html#WaterPollution>







COMPLETE C.P. SUBMITTAL

- Geohydrologic Survey (WWTPs)
- Anti-degradation Review (WWTPs)
- Engineering Report or Facility Plan
- Construction Permit Application
- Construction Permit Fee
- Required Documentation
- Missouri Registered Professional Engineer's Seal, Signature, and Date





Construction Permit Applications

- Sewer Extension Application
 - Applicable Gravity Sewer Lines
 - Lift Stations
 - Force Mains
- Wastewater Treatment Plant Application
 - Discharge
 - No Discharge (MOG 823 – Domestic, <50,000 GPD,)
 - <3,000 GPD Domestic Non-discharging (drip irrigation) Exempt -----See Dept. of Health!



Land Application



Drip Irrigation



Construction Permit Application Fees

- Sewer Extension
 - Gravity Sewer Lines
 - less than a total of 1,000 feet of gravity pipe and/or force main and 1 pump station – **EXEMPT!** (2013 House Bill 28, RSMo 644.051)
 - \$300 / \$300 if greater than or equal to 1,000 feet of pipe
 - Lift Stations - \$300 / \$300
 - Force Mains - \$300 / \$300



Construction Permit Application Fees

- Domestic Wastewater Treatment Plant
 - \$750 / \$1,000 if Design Average Flow is less than 500,000 gallons per day (gpd)
 - \$2,200 / \$3,000 if Design Average Flow is equal to or greater than 500,000 gpd



Required Documentation

- Sewer Extensions
 - Two copies of the engineering report
 - Projects limited to 8-inch gravity sewers are exempt from submitting an engineering report
 - Initially one copy of the plans and specifications is to be submitted (include ELECTRONIC) [SRF – Three copies of the final P&S].

Required Documentation (continued)

- Sewer Extensions
 - Summary of design
 - Letter from the continuing authority agreeing to accept the additional flow
 - Letter from the receiving wastewater treatment facility, if different than the continuing authority

Required Documentation (continued)

- Domestic Wastewater Treatment Plant
 - Anti-degradation Review
 - Two copies of the facility plan
 - Summary of design
 - For systems with a design flow $\geq 22,500$ gpd, the facility plan must be approved before submittal of P&S
 - Initially one copy of the plans and specifications is to be submitted (include ELECTRONIC) [SRF – Three copies of the final P&S].

Improvements

- Emphasis to Electronic submittals (often CD works, also FTP site)
- Separate Construction Permit From Operating Permit (Forms)
- No Operating Permit is needed unless adding limits or conditions
- Eliminated Operating Permit Application after Construction is Completed

Improvements

- Unresponsive Applicants – Close Projects
- Reviewer Assignments (CP & OP)
- Concept - MOG for Sewer Extensions
- New MOG for Small Domestic
 - (<50,000 gpd)
 - Effluent limits based on flow and setting
 - Close of comments 3/24/14

Construction Permit Process

John Rustige, P.E.

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Rule Revisions:

10 CSR 20-6.010 & 10 CSR 20-8

Engineering Workshops, March 2014
Leasue Meyers, EIT





6.010(1): General

- Pilot Projects
 - Removes small scale
 - Clarifies that an application for operating or construction permit is required if permanent
- Addition to the New Technologies Factsheet
- The request should include:
 - The ultimate goal of the project
 - The length of time expected to last
 - The flow regime expected to be used in the project
 - Any chemicals used in the project, along with MSDS
 - Planned sampling and testing events



6.010(1): General

- Affordability
 - 644.145, RSMo required development of procedures
 - Finding of affordability to POTWs when issuing permits containing new environmental requirements
 - Utilizing the Department's guidance or other applicant submitted affordability information. Department's Guidance: <http://dnr.mo.gov/env/wpp/cwforum/affordability-draft-guidance080612.pdf>
 - Affordability finding not required for sewer extension, no new environmental requirements
 - Communities greater than 3,300 can waive the affordability finding

6.010(2): Continuing Authority

- Availability demonstration on part of the Applicant, one of the following:
 - A written statement from the higher authority declining the wastewater;
 - The collection system operated by a higher preference authority is beyond 2,000 feet;
 - Connection by the higher authority exceeds 120% of the applicant's cost of the wastewater system;
 - Proposed service fee on the users by the higher authority is above what is affordable for existing homeowners;
 - Terms for connection by the higher authority require more than 2 years to achieve full sewer service; or
 - Terms for connection by the higher authority are not viable or feasible to homeowners.

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6.010(2): Continuing Authority Level 2 Process

- Submit a preliminary request to the Clean Water Commission
- Develop a plan, which includes, but not limited to:
 - Discussion of Regional Treatment service plan;
 - Capital Improvements Program;
 - Process to provide waivers when sewer connection is not available;
 - Process to address environmental issues in the service area;
 - Process to address noncompliant facilities in the service area;
 - Community financial information; and
 - Defined service area map.
- Develop local ordinance authority to compel wastewater users and facilities to connect
- Allow public participation during development.

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6.010(3): Construction Permits

- Applicability
- Construction Permits are required for the following activities:
 - New and modified domestic wastewater discharges;
 - New and modified surface and subsurface wastewater irrigation;
 - Any Department financed project
 - New and modified earthen basins used for wastewater treatment;
 - Sewer extensions; and
 - New and innovative technologies for domestic and publicly owned wastewater treatment, as defined by 10 CSR 20-8.020 or 10 CSR 20-8.140.

6

6.010(3)(B): Construction Permits

- 644.051, RSMo
- A construction permit may be required where necessary as determined by the Department, including, but not limited to, the following:
 - Substantial deviation of 10 CSR 20-8 Design Guides;
 - To address noncompliance;
 - When an unauthorized discharge has occurred or has the potential to occur; or
 - When a discharge results in violation of water quality standards covered in 10 CSR 20-7.031.



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6.010(3)(C): Construction Permits

- List Activities Already Exempt from Construction Permitting:
 - Construction of a separate storm sewer;
 - Class II CAFO & smaller AFO, as designated in 10 CSR 20-6.300;
 - Stormwater best management practices, as defined in 10 CSR 20-6.200;
 - Industrial facilities connecting to a POTW (pretreatment facilities); and
 - Like for like replacement (e.g., replacing 8" pipe with 8" pipe, same location and grade, but different material type);



Horizontal lines for handwritten notes.

6.010(3)(C): Construction Permits

- Establishes Activities EXEMPT from Construction Permitting
 - Sewer extensions 1,000 feet or less, with 1 pump station;
 - Nondomestic discharges of process wastewater;
 - Facilities evaluated & constructed under other Department programs;
 - Phosphorus removal systems using common metal salts & tertiary filtration;
 - Pre-engineered dechlorination equipment;
 - Sludge processing equipment; and
 - Outfall relocation;
- Activities may still require Antideg & Operating Permit Mods



Horizontal lines for handwritten notes.

6.010(3): Construction Permits

- Documents items required for construction permit
 - Electronic submittal of documents
 - Summary of Design
 - Soil morphology for subsurface
 - Geohydrologic Evaluation
 - Emphasizes Land Application Evaluation
- If operating permit modification is required, apply at the same time or prior to construction permit
 - Major Modifications
 - New Treatment Plants
- If renewal reflected final effluent limits and other changes, not re-public noticing.



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6.010(3): Construction Permits

- 2 year Construction Permits Default
 - Shorter permits where appropriate
 - Longer permits with justification due to complexity & scope
- Statement of Work Completed
 - Existing Condition, but not consistently receiving
 - If changes from the plans and specification used to issue CP, submit electronic copy of as-builts
 - Submittal for issuance of operating permit
 - Signed by the Engineer
 - New Form: <http://dnr.mo.gov/forms/780-2155-f.pdf>



14

6.010(4): Supervised Programs

- Sewer Extension Authority
 - Previously existed in Section (6) of current rule
 - Request Authority from the Department, documenting:
 - Engineering & Inspection Capabilities
 - Standard technical specifications
 - Engineering Report on existing collection system capacity
 - Current map of collection system
 - Condition of Operating Permit
 - Clarifies approval will be reevaluated at Operating Permit Renewal

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6.010(4): Supervised Programs

- Treatment Plant Authority
 - Established in 644.051, RSMo
 - Communities with one treatment plant **1 MGD or greater**
 - Request Authority from the Department, documenting
 - Engineering & Inspection Capabilities
 - Existing Treatment Plant, along with summary of design and remaining capacity
 - Condition of Operating Permit
 - Approval will be reevaluated at Operating Permit Renewal
 - Subject to Antideg & Permit Mod for new pollutants or design flow changes

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6.010(5-9): Operating Permits

- Standard Conditions Parts recently updated
 - Part I effective **November 1, 2013**
 - Part II effective **May 1, 2013**
 - Part III effective **March 1, 2014**
- If construction permit exempt, must still document designed to Ch. 8 Design Guides and signed & sealed by Missouri Registered Professional Engineer
- Updates language for consistency and clarity
- Fixes statutory conflict for general permits on when applications are due
- Clarifies operating permits can be issued for less than 5 years



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6.010(10): Closure

- Closure Requirements are applicable to wastewater facilities
- Closure Plan required to be submitted and approved
 - Plan must address
 - Sludge and wastewater removal
 - Removal or leave in place for Solid Waste
 - Closure schedule
 - Vegetative Cover
 - Land Disturbance Permit, as applicable
- Standard Conditions Part III effective **March 1, 2014**
- Closure Plan Factsheet
- Closure Plan Template } IN DEVELOPMENT

18

10 CSR 20-8 Revisions

- All sections of Chapter 8 will be revised
- Incorporate Small Design Guides (8.020) into revised Sections, with appropriate exemptions
- **2014 Focus**
 - 8.140 Sewage Treatment Works
 - 8.180 Biological Treatment
 - 8.190 Disinfection
- Forum Page under Current Advisory Groups: Chapter 8 Wastewater Design Guide Revisions
 - <http://dnr.mo.gov/env/wpp/cwforum/chapter8workgroup.htm>



8.140 Sewage Treatment Works

- Stakeholder Groups ongoing
- Last Updated in 1979
- Updates:
 - 10 State Standards Revisions
 - Technology Definitions for new and innovative technologies.
 - Chemical Storage
 - Alarm Systems
- Next Stakeholder Meeting:
 - **May 21, 2014 at Lewis & Clark**



8.180 Biological Treatment

- Last Updated in 1979
- Update includes:
 - Ammonia & Nutrient Treatment
 - Suspended Growth Treatment Technologies
 - Attached Growth Treatment Technologies
 - 10 State Standards
 - Reviewing other states updated design guides for consistency clarity
- Stakeholder Meetings Start **July 2014**



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8.190 Disinfection

- Stakeholder Groups ongoing
- Last Updated in 1979
- Updates include
 - 10 State Standards Revisions
 - Addition of UV and Peracetic Acid
 - MBR & disinfection discussion
 - Requirement to maintain spare parts
- Next Stakeholder Meeting:
 - May 21, 2014 at Lewis & Clark**



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6.300, 8.300 & 8.500 CAFO and AgChem Revisions

- 6.300
 - Responding to comments received, including EPA
 - Operating Permit discussion, removed construction discussion
- 8.300 & 8.500
 - Design Guidance
 - Removes Construction Permit Discussion
- Next Stakeholder Meeting:
 - April 15, 2014 at Lewis & Clark**
- Questions: Diane Reinhardt or Greg Caldwell



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Summary

- Continuing Authority Availability Definition
- Construction Permit Exemptions
- General Permit for Sewer Extensions
- Submit Operating Permit modification with Construction Permit
- Public Notice when establishing new requirements, not previously public noticed
- Statement of Work Completed to get Operating Permit
- Variance Procedures
- Stakeholder Groups are ongoing, **please participate!**



Resources Revision

- Updated: Construction Permit Manual
- Updated: Operating Permit Manual
- Updated: New, Innovative, & Pilot Technologies Factsheet
- New: Level 2 Continuing Authority Factsheet
- New: Closure Plan Factsheet
- New: Variance Factsheet
- Updated: Forms

<http://dnr.mo.gov/pubs/index.html>



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Questions?

– Contact Leasue

- leasue.meyers@dnr.mo.gov
- (573)751-1300
- PO Box 176, Jefferson City, MO 65102



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**- Geohydrologic Evaluations -
Environmental Assistance Unit**

Sherri Stoner, R.G.
Geological Survey Program

Wastewater Engineering – Regulation Changes and Construction Permit Process
March 2014



What is a Geohydrologic Evaluation?

- The objective of a geohydrologic evaluation is to examine site-specific geologic and hydrologic conditions.
- Determine the potential of the facility to impact groundwater.

When do I Need to Have a Geohydrologic Evaluation Performed?

- In accordance with 10 CSR 20-7.010 through 10 CSR 20-7.031
- and
- 10 CSR 20-8.010 through 10 CSR 20-8.500, these evaluations are required for:

When do I Need to Have a Geohydrologic Evaluation Performed?

- Both new and modified earthen lagoons, with or without discharge
- Mechanical treatment plants
- Recirculating filter beds
- Land application sites
- Other types of wastewater treatment facilities

When do I Need to Have a Geohydrologic Evaluation Performed?

At the beginning stages of the permitting process.

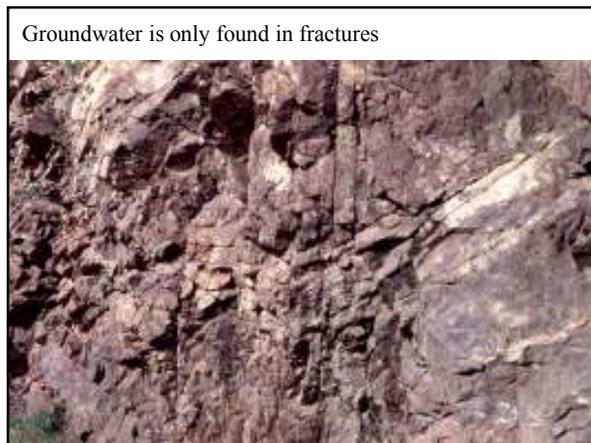
Where Can I Get the Request for a Geohydrologic Evaluation??

- Missouri Department of Natural Resources website at <http://dnr.mo.gov>
 - Forms and Permits tab
 - Search the Geology Category
 - Geological Survey
 - » Request for Geohydrologic Evaluation of Liquid-Waste Treatment Facility/Site



Site Visit By a Geologist... What Are We Looking At?

- Bedrock - permeability





Site Visit By a Geologist... What Are We Looking At?

- Bedrock - permeability
- Surficial materials - permeability

Surficial materials are highly variable
Thick deposits
Wind-blown Loess (up to 50 feet)
Glacial Till (up to 200 feet)





Site Visit By a Geologist...What Are We Looking At?

- Bedrock - permeability
- Surficial materials - permeability
- Hydrology of the site

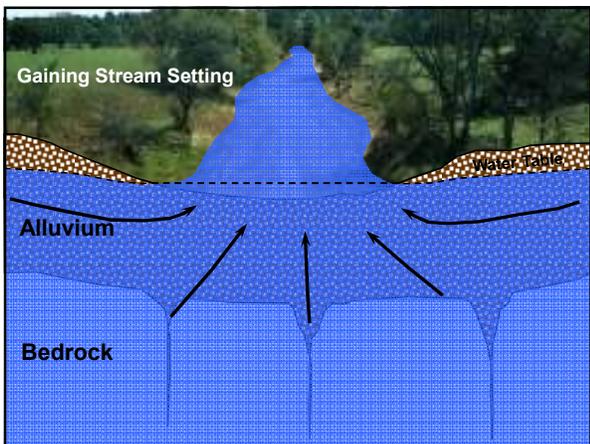
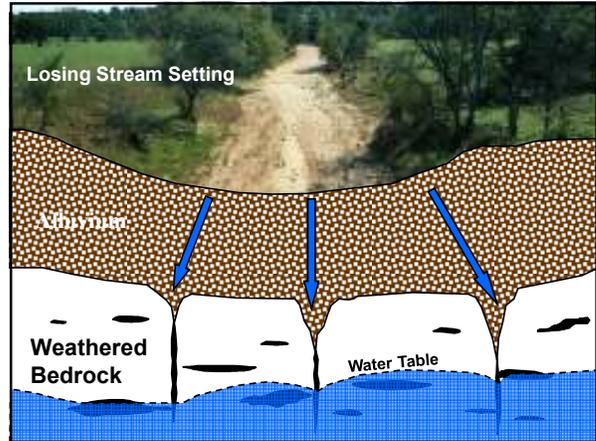




Geologic Stream Classification

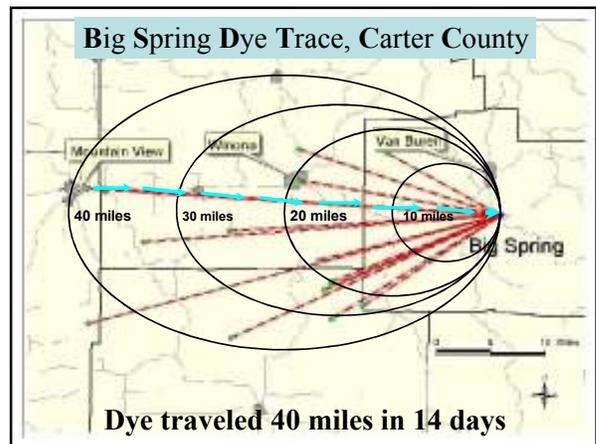
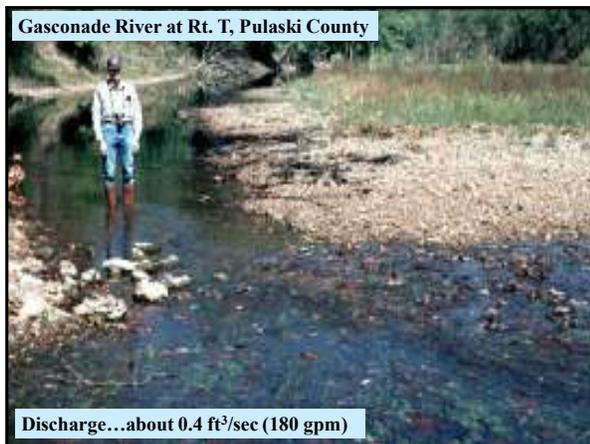
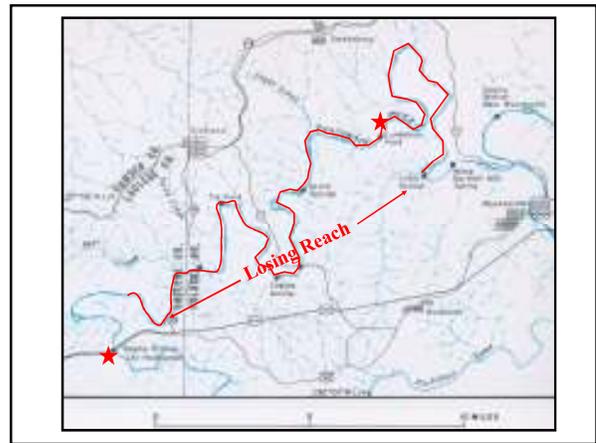
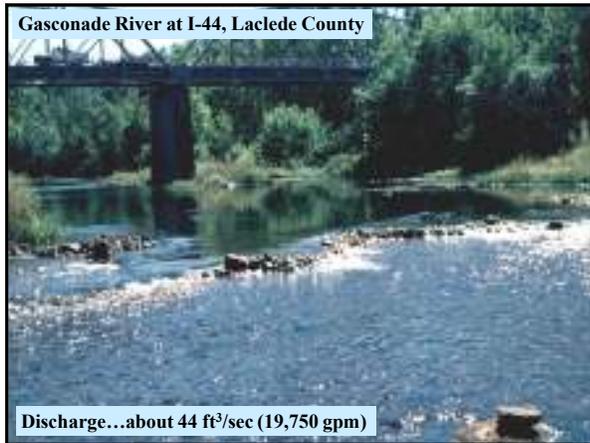
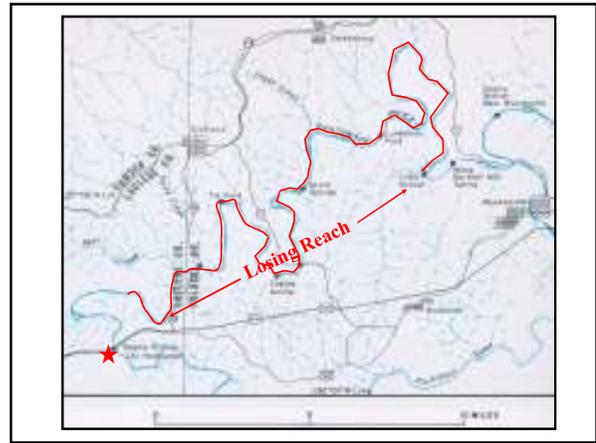
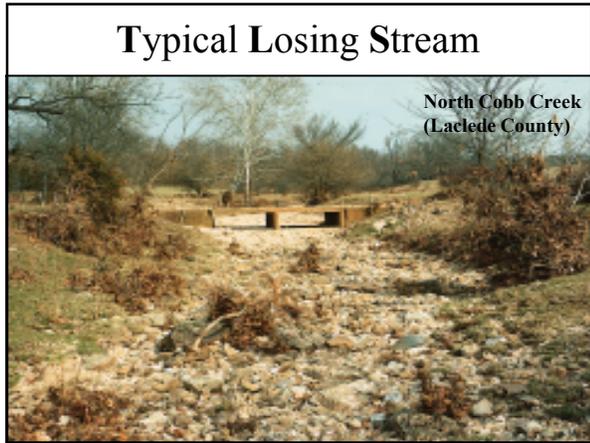
Gaining
or
Losing

LOSING STREAM....
A stream that loses a significant part of its normal runoff into bedrock openings beneath the streambed.

A photograph of a dry, sandy streambed in a rural landscape. The streambed is wide and composed of light-colored sand and silt. The surrounding area is green with trees and grass.

Typical Losing Stream

A photograph of a typical losing stream in a wooded area. The streambed is rocky and the water is shallow. The surrounding area is wooded with bare trees. The text "Laclede County" is visible in the bottom right corner.



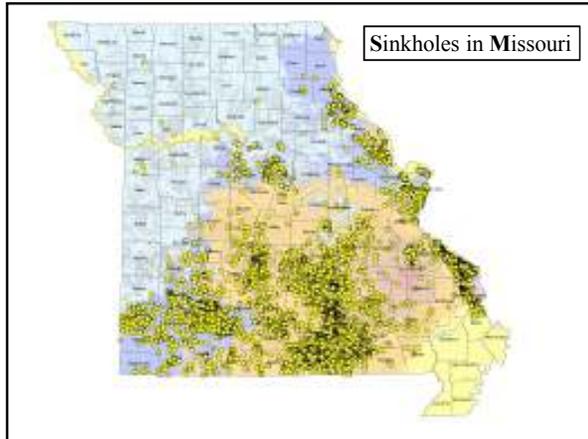
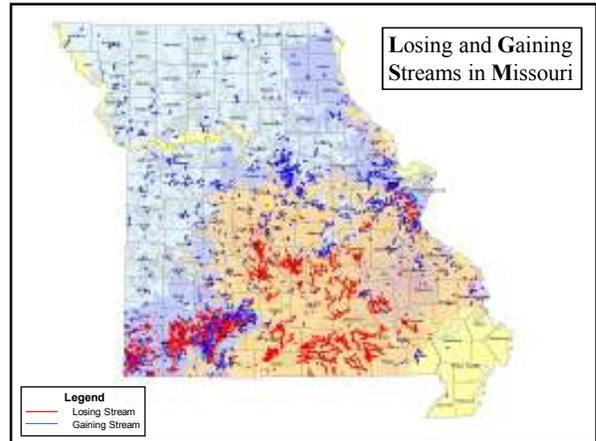


Schluersburg Karst Chasm

July 2000
Completely filled with
coarse gravel



January 2000
237 feet long, 30 feet deep,
5 to 10 feet wide

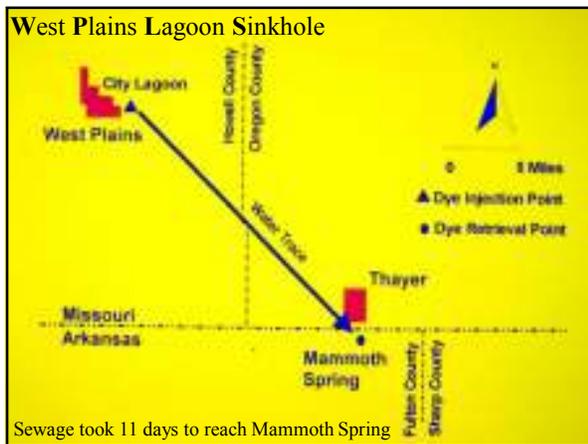




Karst areas are underlain by highly permeable bedrock and soils...

Groundwater aquifers are highly susceptible to contamination from the surface!!!

Just How Susceptible???



Evaluation of Collapse Potential of Liquid-Waste Treatment Site

Required for new or modified earthen lagoons/storage basins

Evaluation of Collapse Potential of Liquid-Waste Treatment Site

- Stream classification
- Depth to water table
- Bedrock
- Proximity of sinkholes and underground openings

Evaluation of Collapse Potential of Liquid-Waste Treatment Site

- Residuum thickness
- Surface area of facility
- Maximum operating depth

Evaluation of Collapse Potential of Liquid-Waste Treatment Site

Slight
Moderate
Severe

Geologic Limitations Rating

Slight
Moderate
Severe

Slight Geologic Limitations Rating

	Earthen Facilities	Mechanical Treatment Plant
Surficial Materials	Sufficient materials present on site which can be compacted to achieve low permeability	Not applicable
Bedrock	Low permeability below a weathered zone or a surficial material thickness and permeability which makes bedrock unimportant	Not applicable
Receiving Stream	Receiving stream must be gaining for 2 miles downstream of the discharge point for discharging facilities Streams may be losing if non-discharging facility	Receiving stream must be gaining for 2 miles downstream of the discharge point for all discharging facilities
Collapse Potential	Slight	Not applicable
Required Construction	Compacted clay liner Facility must meet gaining stream effluent quality standards	Must meet gaining stream effluent quality standards
Impact	Liner or treatment failure can affect local shallow groundwater in alluvium or other limited shallow groundwater supplies	Treatment failure can affect local shallow groundwater in alluvium or other limited shallow groundwater supplies

Moderate Geologic Limitations Rating

	Earthen Facility	Mechanical Treatment Plant
Surficial Materials	Surficial materials onsite or nearby which can be compacted or artificially sealed to achieve low permeability	Note: Moderate geologic limitations do not apply to mechanical treatment plants
Bedrock	Low to high permeability	
Receiving Stream	Receiving stream must be gaining for 2 miles downstream of the discharge point for discharging facilities Streams may be losing if non-discharging facility	
Collapse Potential	Slight or Moderate	
Required Construction	Thickness of compacted clay liner determined by Division of Environmental Quality May also require: artificial sealing, depth limits, subsurface diversion of water, and/or rock excavation Facility must meet gaining stream effluent quality standards	
Impact	Liner or treatment failure can affect local, shallow and/or regional groundwater supplies	

Severe Geologic Limitations Rating

	Earthen Facility	Mechanical Treatment Plant
Surficial Materials	Highly permeable or an insufficient amount of surficial materials onsite or nearby. Surficial materials can not be remolded or sealed to achieve low permeability	Not applicable
Bedrock	High permeability	Not applicable
Receiving Stream	Losing within two miles downstream of the discharge point	Losing within two miles downstream of the discharge point
Collapse Potential	Moderate or severe. If a severe collapse potential rating is given then overall geologic limitations rating must also be severe.	Not applicable
Required Construction	Mechanical treatment plant, or reinforced concrete facility	Facility must meet losing stream effluent quality standards.
Impact	No earthen lagoon storage of waste is permitted. Treatment failure can affect regional groundwater supplies	Treatment failure can affect regional groundwater supplies.



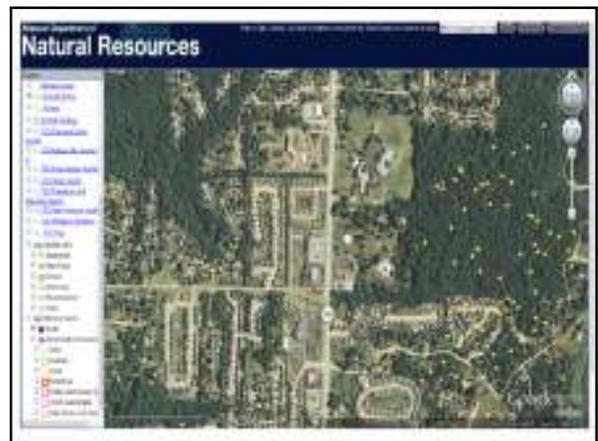
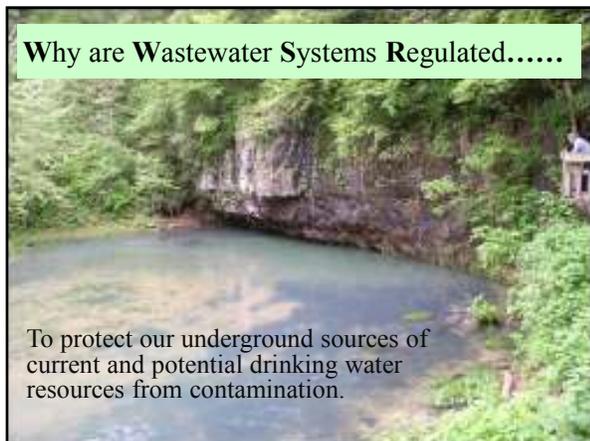
Sinkhole due to soil piping into 9-inch fracture



Cedar County

Why are Wastewater Systems Regulated.....

To protect our underground sources of current and potential drinking water resources from contamination.





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resources.

**40
years**

Missouri Department of Natural Resources

Thank You

- Sherri Stoner, R.G.
- 573-368-2129
- sherri.stoner@dnr.mo.gov
- Department's website: <http://dnr.mo.gov>



No-Discharge – Land Application

Keith Forck
 573-526-4232
 keith.forck@dnr.mo.gov
 March 2014 Wastewater
 Engineering Workshop





No-Discharge – Land Application

- **Storage Basin/Lagoon with Irrigation**
- Septic Tank with Sub-Surface Distribution
- Secondary Treatment with Drip Irrigation



Design Guides

- 10 CSR 20 Chapter 8
- Small Systems 10 CSR 20-8.020
 - (11)(A) Access Road
 - (11)(C) Fence and Signs
 - (13)(A) Basin Requirements – Berm, Liner, Piping, and Stormwater Diversion
 - (15) Storage and Irrigation Requirements

Design Guides

Large Systems

- 10 CSR 20-8.200
 - (4) Stormwater Diversion
 - (6) Basin Details – Berm, Liner, and Piping
 - (8) Access Road, Fence, and Signs
- 10 CSR 20-8.220
 - Storage and Land Application



Other Requirements

1. Primary Treatment
2. Permanent Pumpdown Marker
3. Emergency Spillway
4. Operation and Maintenance Manual
5. No Public Access unless Disinfection
6. Geohydrologic Evaluation



Storage Volume Requirements

Need to consider the 1 in 10-year rainfall minus evaporation for the design storage period.

Need to consider the weather and irrigation area in the design storage period. Minimum storage periods range from 60 days in southern Missouri to 120 days in the north.



1 in 10 year: 120-day Rainfall minus Evaporation



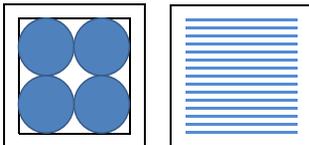
Land Application Guidelines

- Effective area of approximately 0.7 acres for each 1000 gallons per day dry weather design flow, which on small systems will be an acre or more of actual area.



Land Application Guidelines

- Effective area is the area effectively irrigated whether it be linear or circles.

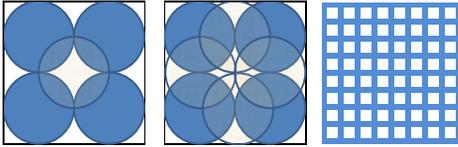


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Land Application Guidelines

- Irrigation areas should not overlap.



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Land Application Guidelines

- Slopes should be less than ten percent.
- Irrigation area must be cropped/vegetated.
- Grazing and forage harvesting deferment.



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General Permit MO-G823xxx

Applicability

- Domestic Wastewater Only
- Less than 50,000 gallons per day
- No POTW or PSC regulated facilities
- No public access areas for irrigation



Benefits of No-Discharge Systems

- No effluent limitation for ammonia
- No concern about future effluent limitations for ammonia and nutrients
- No Effluent Disinfection
- Monitoring Requirements are minimal



Partial Irrigation

Don't have enough storage for a no-discharge system?

Not enough land for irrigation?

Then consider partial irrigation.

Permit is somewhat more complex as it allows for discharge based on the prescribed conditions.



Reasons for Partial Irrigation

1. Do not have to disinfect during the recreational season.
2. Avoid a timeframe for ammonia or disinfection limitation issues.
3. Want to use a little water for irrigation, but not large scale enough for no discharge.





Partial Irrigation Permit Example

OUTFALL NUMBER AND EFFLUENT PARAMETER(S)		UNITS	EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
			DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Outfall #001 – Discharge (Note 1) Flow MGD * 65 45 once month 24 hr. estimate Biochemical Oxygen Demands ** mg/L 110 70 once month grab Total Suspended Solids MGD 15 10 once month grab Oil & Grease mg/L **** once month grab pH – Units SU **** once month grab Ammonia as N mg/L 3.6 1.4 once month grab (May 1 – Oct 31) 7.5 2.9 (Nov 1 – April 30) # 100mL 630 126 once month grab E. Coli (Note 2)							
MONITORING REPORTS SHALL BE SUBMITTED MONTHLY. THE FIRST REPORT IS DUE April 28, 201X. THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.							



Partial Irrigation Permit Example

EFFLUENT PARAMETER(S)	UNITS	FINAL LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Permitted Feature #001 – Lagoon Operational Monitoring (Notes 3 & 4) Storage Basin Freeboard (Note 5) feet * once month measured Precipitation inches * daily total						
Permitted Feature #002 – Land Application Operational Monitoring (Note 4) Irrigation Period hours * daily total Volume Irrigated gallons * daily total Application Area acres * daily total Application Rate inches * daily total						
Irrigated Wastewater (Notes 4 & 6) Total Kjeldahl Nitrogen as N (Note 7) mg/L * once year grab Nitrate Nitrogen as N (Note 7) mg/L * once year grab						
MONITORING REPORTS SHALL BE SUBMITTED ANNUALLY. THE FIRST REPORT IS DUE JANUARY 28, 20XX						



3000 Gallon Per Day or Less No-Discharge Permit Exemption for Domestic Wastewater

- No permits required
- Domestic waste only
- On-site land application or pump and haul to permitted treatment facility.
- Not applicable for subdivisions

3000 GPD or Less Exemption (cont.)

- Exemption good today, but may go away...
- Construction requirements in accordance with 10 CSR 20-8.020
- Operation and maintenance must be performed
- For more information, see Fact Sheet 1319:
<http://www.dnr.mo.gov/pubs/pub1319.pdf>



No-Discharge – Land Application

Byron Shaw



Drip Irrigation – Keys to Success

- Secondary treatment prior to drip field
- In depth soils morphology test by a soil scientist
- Geohydrologic Evaluation
- Use conservative design/multiple zones
- Operation and maintenance

Possible Methods of Secondary Treatment

- Mechanical treatment plants and sand filters are most common on smaller systems
- Facultative or aerated lagoons



Soils Morphology Test

- A soil scientist, as defined in 19 CSR 20-3.080 must prepare a soils report
- Soil observation pits (backhoe or hand dug) dug to a depth to reveal the major soil horizons





Geohydrologic Evaluation

- Performed by the department's Missouri Geological Survey





Use conservative design/multiple zones

- Application rate is based upon the types of soils present
- Use of multiple zones allows each area to rest between dosings
- Subsurface Drip Distribution System Fact Sheet

<http://dnr.mo.gov/pubs/PUB2435.pdf>



Operation and Maintenance

- Ensure secondary treatment system is functioning properly
- Effluent pumps
- Disk filters need to be checked
- Maintenance contracts



Mechanical WWTP
with fixed film and
aeration



Fixed Film
Media



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Dosing
Tank



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resources.
40
years
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Installed layout



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resources.
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years
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Installation
of the drip
lines





Drip lines installed



Header pipe –
one on each end



Header pipe with
valve box



Gate
valves



Distribution
valve

Two zones



Air
release
valve



Questions?





Ammonia Treatment Pilot Projects and Other Experiences

Byron Shaw and Refaat Mefrakis





The Department of Natural Resources does not Endorse or Recommend Treatment Systems



Lagoon Upgrades

- LemTec Systems with Polishing Reactor by Lemna Technologies
- Bio-Domes (Poo Gloos) by Wastewater Compliance Systems, Inc. (WCS)
- SAGR (Submerged Attached Growth Reactor) System by Nelson Environmental
- BiO2 Solution
- Biolac by Parkson

LemTec with Polishing Reactor

Screening



LemTec with Polishing Reactor

Lagoon Cover



LemTec with Polishing Reactor

Lagoon Cover



LemTec with Polishing Reactor

Polishing Reactor



LemTec with Polishing Reactor

Polishing Reactor



LemTec with Polishing Reactor

UV Disinfection



Poo Gloos WCS

Poo Gloo
Installation



SAGR by Nelson Environmental

SAGR
Cells



BiO2 Solution

BiO2
Solution
Cell



BiO2 Solution Algae Farm Green House



BioLac by Parkson

Screening



BioLac by Parkson

Extended
Aeration
Basin



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BioLac by Parkson

Clarifier



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BioLac by Parkson

UV
Disinfection



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Other Wastewater Treatment Processes

- Activated Sludge
- Fixed Film
- Integrated Fixed Film Activated Sludge

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resources.
40
years
Missouri Department of Natural Resources

Questions?



Aquatic Life Criteria - Ammonia – 2013 Update

Graham Freeman



Overview

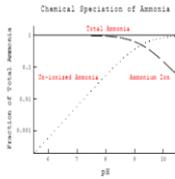
- Ammonia, Sources, and Water Quality Concerns
- History of Aquatic Life Criteria for Ammonia
- 2013 Final Ammonia Criteria
- State Flexibility for New Ammonia Criteria

Ammonia

- Highly Important Pollutant
 - Toxic
 - Ubiquitous
- Anthropogenic Sources
 - Agricultural Fertilizers
 - Industrial Applications
 - Domestic
- Natural
 - Atmosphere
 - Decomposition
- Highly Studied Toxicant

Ammonia Chemistry

- Ammonia exist in two forms in aqueous solutions:
 - Unionized ammonia (NH₃) and ionized ammonium (NH₄⁺)
 - Total Ammonia Nitrogen (TAN) sum of NH₃ and NH₄⁺
- Instantaneous equilibrium equation
 - NH₄⁺ ↔ NH₃ + H⁺
- As pH increases, the ratio of NH₃ to NH₄⁺ increases
- As temperature increases the ratio of NH₃ to NH₄⁺ increases
- Ammonia much more toxic that ammonium



Mode of Action

- Ammonia produced endogenously
- Natural excretion through passive diffusion
- High ammonia concentrations reverse diffusive gradients
- Ammonia build up in internal organs.
- Can lead to:
 - Damaged gills
 - Reduced blood oxygen capacity
 - Impaired metabolic functions of internal organs
 - Reduced valve opening
 - Lipid and carbohydrate depletion
 - Physiological effects



EPA Recommended Ammonia Criteria

- Original Criteria Introduced in 1976
 - Updated in 1985
- 1999 Revision
 - Acute: salmonids
 - Chronic: Hyalella (benthic crustacean) and early life stages
 - Temperature and pH considerations
- 2004 EPA Federal Registry
 - Intent to revisit ammonia criteria
 - Response to U.S. Fish and Wildlife Concern
- 2009 Draft Criteria
 - Reflected mussel and gill bearing snail sensitivity to ammonia
 - Bifurcated criteria – presence/absence of mussels





MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Wastewater Engineering – Regulation Changes and Construction Permit Process

Summary of resources and web addresses related to the specific workshop presentations:

Water Quality and Antidegradation Review Assistance

- Antidegradation Implementation Main Page:
<http://dnr.mo.gov/env/wpp/permits/antideg-implementation.htm>
- Example Antidegradation Report Outline:
<http://dnr.mo.gov/env/wpp/permits/AIPrptoutline.pdf>
- Natural Heritage Review: <http://newmdcgis.mdc.mo.gov/EnvReview/Default.aspx>
- Geohydrologic Evaluation Request: <http://www.dnr.mo.gov/forms/780-1688-f.pdf>
- Streeter Phelps DO Model: <http://www.ecy.wa.gov/programs/eap/pwspread/pwspread.html>
- Qual2K model: <http://www.epa.gov/athens/wwqtsc/html/qual2k.html>
- DO Modeling & BOD Effluent Limit Development Guidance:
www.dnr.mo.gov/env/wpp/permits/DO_Modeling_Administrative_Guidance_Dec_09.pdf
- EPA Economic Guidance for Water Quality Standards:
<http://water.epa.gov/scitech/swguidance/standards/economics/>
- Missouri Use Designation Dataset. That interactive GIS layer can be found at:
<http://dnr.mo.gov/env/wpp/rules/wpp-rule-dev.htm#interactivemapanduserguide>
- New Technology Definitions and Requirements: <http://www.dnr.mo.gov/pubs/pub2453.pdf>

Facility Plan/Engineering Report Reviews

- Wastewater Construction Permitting Website:
<http://dnr.mo.gov/env/wpp/permits/ww-construction-permitting.htm>
- Facility Plan Guidance: <http://dnr.mo.gov/pubs/PUB2416.pdf>
- Engineering Report Guidance: <http://dnr.mo.gov/pubs/PUB2415.pdf>

10 CSR 20-6.010 – Construction Permits

- Revised Statutes for the State of Missouri Chapter 644 (Missouri General Assembly):
<http://www.moga.mo.gov/>
- Code of State Regulations (Clean Water Commission):
<http://www.sos.mo.gov/adrules/csr/current/10csr/10csr.asp#10-20>
- Water Protection Forum: <http://dnr.mo.gov/env/wpp/cwforum/index.html>
- Chapter 6.010 Stakeholder Group: <http://dnr.mo.gov/env/wpp/cwforum/ca-group.htm>
 - Affordability Guidance:
<http://dnr.mo.gov/env/wpp/cwforum/affordability-draft-guidance080612.pdf>
 - 10 CSR 20-6: <http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-6a.pdf>
- Chapter 8 Design Guides Stakeholder Group:
<http://dnr.mo.gov/env/wpp/cwforum/chapter8workgroup.htm>
 - 10 CSR 20-8: <http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-8.pdf>
 - 10 State Standards:
https://www.broward.org/WaterServices/Documents/states_standards_wastewater.pdf
- CAFO Stakeholder Group: <http://dnr.mo.gov/env/wpp/cwforum/cafo-permit.htm>



MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Wastewater Engineering – Regulation Changes and Construction Permit Process

- Water Pollution Factsheets and Publications: <http://dnr.mo.gov/pubs/index.html#WaterPollution>
- Wastewater Construction Permitting: <http://dnr.mo.gov/env/wpp/permits/ww-construction-permitting.htm>
 - Wastewater Engineering Construction Permitting Manual: <http://dnr.mo.gov/env/wpp/permits/const-permit-manual.htm>
 - Wastewater Construction Permit Manual: <http://dnr.mo.gov/pubs/pub2445.pdf>
 - New Technology: <http://dnr.mo.gov/pubs/pub2453.pdf>
- NPDES Operating Permit Manual: <http://dnr.mo.gov/env/wpp/permits/manual/permit-manual.htm>
 - Standard Conditions Part I: <http://dnr.mo.gov/env/wpp/permits/sc1-102813.pdf>
 - Standard Conditions Part II: http://dnr.mo.gov/env/wpp/permits/npdes_part_II.pdf
 - Standard Conditions Part III: <http://dnr.mo.gov/env/wpp/permits/sc3-030114.pdf>
- Water Pollution Forms: <http://dnr.mo.gov/forms/index.html#WaterPollution>
- Construction Permit Form: <http://dnr.mo.gov/forms/780-2189-f.pdf>
- Statement of Work Completed: <http://dnr.mo.gov/forms/780-2155-f.pdf>
- MOGD – Non-POTW’s Discharging <50,000 GPD
<http://www.dnr.mo.gov/env/wpp/permits/pn/GD00000.pdf>

Missouri Geological Survey

- Request for Geohydrologic Evaluation of Liquid-Waste Treatment Facility/Site: <http://dnr.mo.gov/forms/780-1688-f.pdf>
- Request for Geohydrologic Evaluation of Residential Housing Development (Subdivision): <http://www.dnr.mo.gov/forms/780-1690-f.pdf>
- Missouri Geological Survey Geo-Sciences Technical Resource Assessment Tool: <http://dnr.mo.gov/geostrat/>
- Interactive Mapper Services: <http://dnr.mo.gov/internetmapviewer/>

No Discharge – Land Application, Sub-Surface Irrigation and 3000 Gallon per Day Exemption

- 3,000 Gallon Per Day or Less No-Discharge Permit Exemption for Domestic Wastewater Design Guidance, Fact Sheet--PUB1319: <http://www.dnr.mo.gov/pubs/pub1319.pdf>
- 10 CSR 20 Chapter 6 – Permits: <http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-6a.pdf>
- 10 CSR 20 Chapter 8 – Design Guides: <http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-8.pdf>
- Master General Permit Template MOG823 - Land Application of Domestic Wastewater: <http://www.dnr.mo.gov/env/wpp/permits/issued/G823000.pdf>
- Subsurface Drip Distribution System Fact Sheet: <http://dnr.mo.gov/pubs/PUB2435.pdf>

EPA Ammonia Criteria:

- EPA Aquatic Life Criteria – Ammonia. 2013 Final Ammonia Criteria: <http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/ammonia/>

Ammonia Treatment and Other Experiences:

- New Technology Definitions and Requirements: <http://www.dnr.mo.gov/pubs/pub2453.pdf>
- Ammonia Criteria: New EPA Recommended Criteria: <http://dnr.mo.gov/pubs/pub2481.htm>