VILLAGE OF BARRINGTON HILLS

Board of Health

NOTICE OF MEETING

Tuesday, February 10, 2015 ~ 7:30 pm
112 Algonquin Road

AGENDA

1. Organizational
   1.1 Call to Order
   1.2 Roll Call

2. [Vote] Minutes

3. [Vote] Septic Variance – 11 Peraino circle

4. [Discussion] Water Quality Study
   4.1 Village Hall Level II Test Results
   4.2 Level II Program
   4.3 Groundwater Aging

5. [Discussion] Septic Amendments Draft
   5.1 IDPH Status Report
   5.2 Septic Flow Rates for Barns & Stables

6. Public Comment

7. Trustee's Report

8. Adjournment

Chairman: Gwynne Johnston

Next Regular Meeting, Tuesday, March 10, 2015

NOTICE AS POSTED

VILLAGE OF BARRINGTON HILLS
BOARD OF HEALTH MEETING
January 13, 2015

The regular meeting of the Village of Barrington Hills Board of Health was called to order at 7:30 p.m. by Chairman Johnston.

Board of Health Members Present:	Gwynne Johnston, Chairman Shirley Conibear, M.D. Anne Majewski, M.D.
Board of Health Members Absent:	Frank J. Konicek, M.D., Vice Chairman
Others Present:	Michael Harrington, Village Trustee Robert Kosin, Director of Administration Dan Strahan, Village Engineer

APPROVAL OF MINUTES: Dr. Majewski made a motion to approve the minutes of the December 9, 2014 meeting of the Board of Health. The motion was seconded by Dr. Conibear and approved unanimously.

SEPTIC CODE AMENDMENT SEC. 4-2-7: Mr. Strahan introduced the topic of the proposed amendments to the septic ordinance, noting that no vote was anticipated prior to preliminary approval of the Illinois Department of Public Health.

Mr. Strahan provided background on the rationale for the proposed amendments, noting that amendments required by the Illinois Department of Public Health had resulted in 5 variance applications for at-grade and mound septic systems during the course of the year in 2014. The Board of Health had requested that the Code be amended so that mound and at-grade systems were allowable without the variance. Mr. Strahan then reviewed the primary areas affected by the proposed amendments. It was noted that the draft amendments would be submitted to the Illinois Department of Public Health for preliminary review prior to returning to the Board of Health for a recommendation.

Mr. Strahan also noted that a memo had been prepared presenting research that had been requested by the Board of Health pertaining to acceptable flow rates for commercial barns and stables. Mr. Strahan noted based on a review of local and regional septic codes he was unable to find any regulations that specifically prescribed a flow rate for horse barns. After discussion, Dr. Majewski made a motion requesting that the Village Engineer return with recommended guidelines for reasonable flow rates for septic systems for residential, recreational, or commercially used horse barns. The motion was seconded by Dr. Conibear and passed unanimously.

__HORSE DENSITY/LIVESTOCK REPORT:__ Mr. Kosin noted that the Village had requested and received a response from Debra Hagstrom regarding her recommendations regarding horse density standards with the Village. Dr. Majewski noted that the response received seemed bias towards horse owners and did not seem to reflect or consider uses in Barrington Hills. Mr. Kosin noted Ms. Hagstrom's background and confirmed that she had not been paid for her opinion. After discussion the report was noted as received and no further action was taken.

__GROUNDWATER PROGRAM:__ Mr. Kosin reviewed the status of the proposed program to test water samples at various public/institutional uses throughout Barrington Hills. It was noted that the test had already been performed at the Village Hall well and results were anticipated shortly. Mr. Kosin noted that the recommendation was received by BACOG to perform testing at a frequency of five years.

Chairman Johnston stated and noted concurrence of the Board that baseline testing was desirable. There was discussion that the recommended frequency of five years was too long of an interval and recommended more frequent testing to track water quality over time and that annual testing was preferred.

Trustee Harrington recommended that the Board make specific recommendations to the Board regarding the proposed testing program. After further discussion, Dr. Conibear made a motion to request approximately $3,000 be budgeted annually to test and monitor groundwater quality at nine locations throughout the Village. The motion was seconded by Dr. Majewski and passed unanimously.

Chairman Johnston discussed that he and other residents may be likely to volunteer data to supplement the public information gathered. Chairman Johnston asked if the Village Attorney could review the topic of keeping private test results exempt from FOIA. Mr. Kosin noted it would be better to work to provide a context for any test results requested through a FOIA request instead of making efforts to conceal the specific source of the data. After further discussion, Dr. Majewski made a motion to request that the Village Attorney provide some guidance to residents regarding the implications of voluntarily participating in the groundwater testing program. The motion was seconded by Dr. Conibear and passed unanimously.

The topic of groundwater aging was on the agenda but further research was needed prior to presentation to the Board

__PUBLIC COMMENT:__ No public comments were made.

__TRUSTEE'S REPORT:__ Trustee Harrington noted that he had communicated the Board of Health position regarding horse density to the Trustees. Trustee Harrington also noted that he would work with Bob to present the proposed groundwater testing program to the Board of Trustees.

__ADJOURNMENT:__ Dr. Majewski motioned to adjourn at 9:11 PM. Dr. Conibear seconded the motion. All present said aye.

GHA GEWALT HAMILTON ASSOCIATES, INC.
CONSULTING ENGINEERS
625 Forest Edge Drive, Vernon Hills, IL 60061
TEL 847.478.9700 ■ FAX 847.478.9701
www.gha-engineers.com

January 30, 2014

Ms. Natalie Karney
Land Technology, Inc.
3922 W. Main St.
McHenry, IL 60050

Re: 11 Peraino Circle
Review #1

Dear Ms. Karney:

Our office has reviewed the septic system design & grading plan for the proposed garage addition at the above referenced address. Based on our review revisions are needed prior to approval. Our review is based on the septic/site plan prepared by Land Technology, Inc., Drawing #13-168, dated October 9, 2014 and received by the Village on January 14, 2015.

1. A Type IV (at-grade mound) system has been proposed in order to meet the required 24" separation from the limiting layer, found to be at a 29" depth within the proposed septic area. Based on the Village Code a variance from the Board of Health would be required to allow an at-grade mound system. The next two regular Board of Health meetings are scheduled for Tuesday, February 10th and Tuesday, March 10th. The applicant should contact the Village Clerk to request that this item be placed on an upcoming agenda.

2. It is understood that no bedrooms are proposed for the pool house and a design flow rate of 200 gallons per day is indicated on the drawing. Provide a rationale for the proposed design flow rate based on the anticipated use of the structure.

3. Per Village Code, the minimum allowable septic tank size is 750 gallons.

4. Provide a Lake County Watershed Development Permit application for the proposed project.

The above review comments were generated based on the engineering information provided. Additional comments may result as the final plans and associated materials are submitted. Please include with the final engineering submittal a cover letter with a written response to each of the above comments.

Sincerely,
Gewalt Hamilton Associates, Inc.

Daniel J. Strahan, P.E., CFM
Village Engineer

cc: Wendi Frisen, VBH
Matt Murphy, Owner 11 Peraino Circle Barrington Hills, IL 60010

9355.068 11 Peraino - Pool House

SYMBOL LEGEND	
PROP. = PROPOSED IMPROVEMENTS	EX. = EXISTING
STORM MANHOLE	STORM MANHOLE
CATCH BASIN	CATCH BASIN
INLET	INLET
CURB STORM MANHOLE	CURB STORM MANHOLE
CURB CATCH BASIN	CURB CATCH BASIN
CURB INLET	CURB INLET
WATER VALVE VAULT	WATER VALVE VAULT
WATER VALVE	WATER VALVE
HYDRANT	HYDRANT
B-BOX	B-BOX
SANITARY MANHOLE	SANITARY MANHOLE
SANITARY CLEAN-OUT	SANITARY CLEAN-OUT
AERATOR TANK LID	AERATOR TANK LID
LIFT STATION LID	LIFT STATION LID
SEPTIC TANK LID	SEPTIC TANK LID
WELL	WELL
BORING HOLE	BORING HOLE
AIR CONDITIONER	AIR CONDITIONER
ELECTRIC METER	ELECTRIC METER
GAS METER	GAS METER
UTILITY BOX	UTILITY BOX
TRANSFORMER	TRANSFORMER
LIGHT POLE	LIGHT POLE
UTILITY POLE	UTILITY POLE
GUY WIRE	GUY WIRE
SIGN	SIGN
MAILBOX	MAILBOX
STEEL POST	STEEL POST
[illegible] MONUMENTATION	FOUND MONUMENTATION
	FOUND CHISELED CROSS

PAVEMENT TO BE REMOVED

NEW PAVED ASPHALT AREA

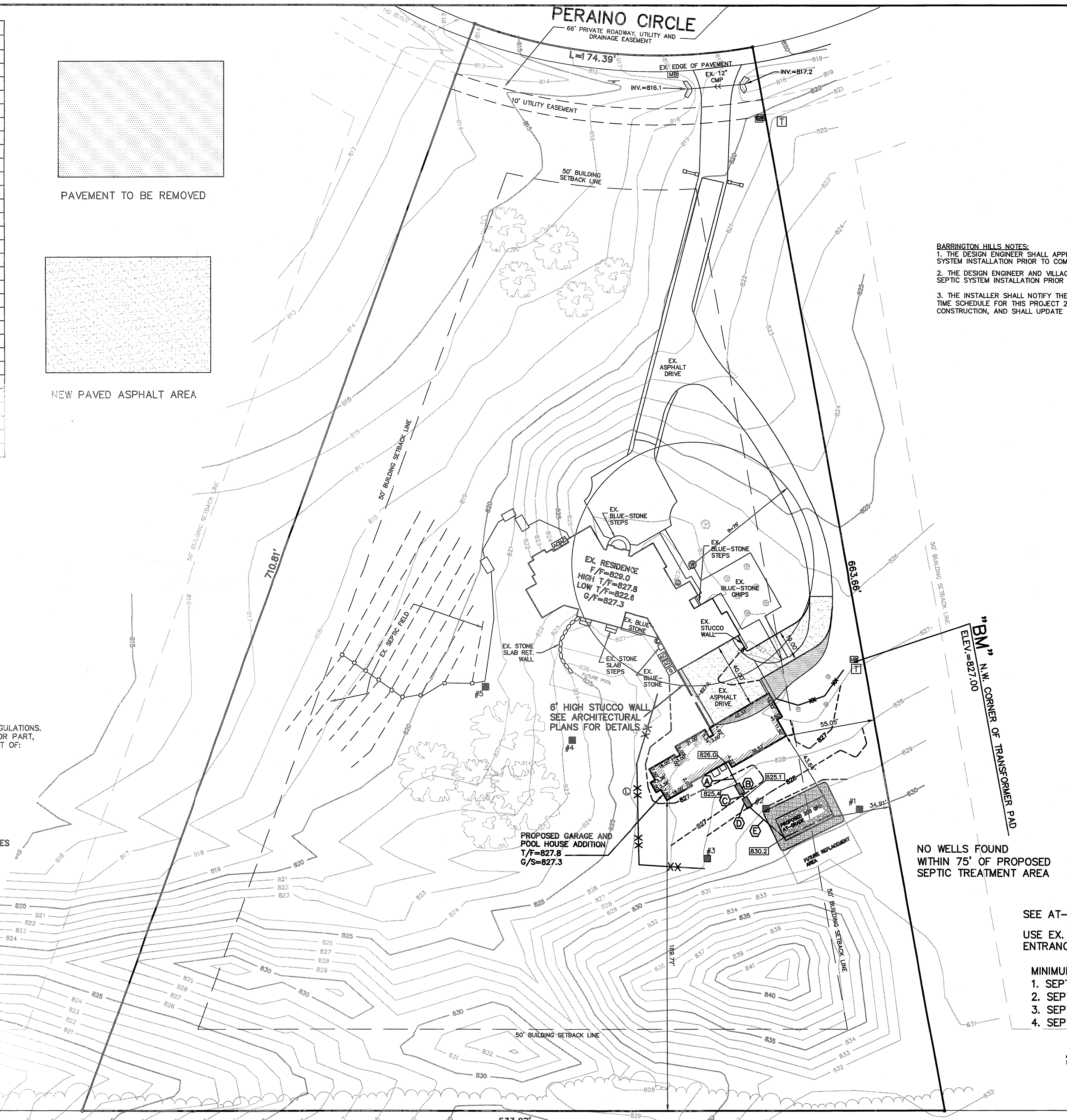
LINE LEGEND
= EX. WIRE FENCE
= EX. WOOD FENCE
= EX. PLASTIC FENCE
= EX. BURIED ELECTRIC LINE
= EX. BURIED GAS LINE
= EX. BURIED TELEVISION CABLE
= EX. BURIED TELEPHONE CABLE
= EX. OVERHEAD WIRES
= EX. STORM SEWER
= PROPOSED WATER MAIN
= PROPOSED SILT FENCE

SITE DATA

TOTAL SITE AREA= 5.32 ACRES
TOTAL PROPOSED IMPERVIOUS = 0.05 ACRES
TOTAL DISTURBED AREA = 0.25 ACRES

DESIGN CRITERIA:

NO BEDROOMS, DESIGN FOR 200 GPD
LOADING RATE 0.40
SOIL GROUP "C" SOILS
LIMITING LAYER @28"
AT-GRADE REQUIRED



SEE AT-GRADE DIMENSIONS ON PAGE 2

USE EX. DRIVEWAY AS CONSTRUCTION ENTRANCE

MINIMUM SET BACK REQUIREMENTS:
1. SEPTIC TANK TO HOUSE – 10.0'
2. SEPTIC TANK TO PROPERTY LINE – 20.0'
3. SEPTIC TREATMENT AREA TO HOUSE – 20.0'
4. SEPTIC TREATMENT AREA TO PROPERTY LINE – 10.0'

SPECIAL NOTE:

"THIS DESIGN IS NOT FOR CONSTRUCTION UNLESS APPROVAL STAMP FROM COUNTY, VILLAGE, OR CITY REGULATORY DEPARTMENT IS AFFIXED HERETO"

LEGEND

(A)- 15 L.F. -4"DIA C.I.P. W/SEALED JTS. OR 5 L.F. 4" DIA C.I.P.AND L.F. 4" DIA. SCH. 40 PVC. AT 2.0% MIN.
(B)- 500 GAL. SEPTIC TANK
(C)- 3 L.F.-4"O PVC (ASTM 3034) AT 1.0% MIN.
(D)- 500 LIFT STATION (SEE DETAIL)
(E)- 29 L.F. 1.5" O SOLID PLASTIC DISCHARGE PIPE.

= PROPOSED PIPE INVERT ELEVATION
= SEPTIC SOIL PROFILE BORING
= PROPOSED FINISH CONTOUR
= EXISTING CONTOUR

EXISTING DECIDUOUS TREE

EXISTING EVERGREEN

BARRINGTON HILLS NOTES:

1. THE DESIGN ENGINEER SHALL APPROVE THE LAYOUT OF THE SEPTIC SYSTEM INSTALLATION PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION.
2. THE DESIGN ENGINEER AND VILLAGE REPRESENTATIVE SHALL REVIEW THE SEPTIC SYSTEM INSTALLATION PRIOR TO COMMENCEMENT OF ANY BACKFILLING.
3. THE INSTALLER SHALL NOTIFY THE DESIGN ENGINEER OF THE PRECISE TIME SCHEDULE FOR THIS PROJECT 2 DAYS IN ADVANCE OF INITIATING ANY CONSTRUCTION, AND SHALL UPDATE THE ENGINEER OF ANY DELAYS.

SPECIAL NOTES:

THIS DESIGN IS BASED UPON (1) THE FIELD CONDITIONS AS THEY WERE ON THE DAY THE PERCOLATION TEST OR SOIL TYPING, AND/OR TOPOGRAPHIC INFORMATION WERE OBTAINED, AND (2) DATA FURNISHED BY THE OWNER, OR GENERAL CONTRACTOR, OR THEIR REPRESENTATIVE – REGARDING BUILDING SIZE, NUMBER OF BEDROOMS, AND/OR PEOPLE WITHIN THE UNIT TO BE SERVED.

ANY DEVIATIONS FROM THESE DESIGN CONDITTIONS SUCH AS (1) CHANGING THE NUMBER OF BEDROOMS, AND/OR PEOPLE TO BE SERVED, (2) REDUCING THE PERCOLATION CAPACITY OF THE SOILS-BY RUNNING HEAVY EQUIPMENT OVER, OR STOCK PILING BUILDING MATERIAL OR EXCAVATED SOIL ON THE SEEPAGE FIELD AREA, (3) REDUCING THE EFFECTIVE SEEPAGE FIELD BY – SIGNIFICANTLY CHANGING, ACTUALLY REDUCING, OR COVERING THE SEEPAGE FIELD WITH PAVEMENT (4) DIVERTING GROUND WATER INTO OR OVER THE SEEPAGE FIELD, OR (5) INTRODUCING OILS AND/OR GREASES INTO THE SEEPAGE FIELD- WILL VOID THIS DESIGN.

GENERAL NOTES

1. THE CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES AND HAVE ALL EXISTING UTILITY INSTALLATIONS LOCATED AND STAKED PRIOR TO CONSTRUCTION.
2. ALL BACKFILL USED FOR THE SEEPAGE FIELD TRENCHES SHALL BE POROUS TOPSOIL CONTAINING LITTLE OR NO CLAY.
3. THE CONTRACTOR SHALL VERIFY ALL EXISTING FIELD CONDITIONS SUCH AS WELL LOCATIONS, HOUSE, EXISTING SEPTIC FIELD LOCATIONS, AND ALL ELEVATIONS PRIOR TO INITIATING ANY CONSTRUCTION.
4. ALL DOWNSPOUTS AND SUMP PUMP SHALL DISCHARGE AWAY FROM THE SEEPAGE FIELD OR INTO A CURTAIN DRAIN. ALSO ALL CLEAR WATER AND CONDENSATE LINES.
5. ALL INSTALLATIONS SHALL CONFORM TO THE APPROPRIATE REGULATORY AGENCY REQUIREMENTS.
6. PRIOR TO THE START OF ANY BUILDING CONSTRUCTION ACTIVITY A TEMPORARY FENCE SHALL BE CONSTRUCTED AROUND THE SEPTIC FIELD AND FUTURE EXPANSION AREAS.
7. THE SEPTIC CONTRACTOR SHALL NOTIFY DESIGN ENGINEER AND VILLAGE REPRESENTATIVE 48 HRS. IN ADVANCE OF INITIATING CONSTRUCTION.
8. SEEPAGE FIELD CONSTRUCTION, OR PLACING OF TOPSOIL IS NOT PERMITTED UPON WET OR FROZEN GROUND.
9. NO LAWN IRRIGATION SYSTEMS SHALL BE INSTALLED WITHIN 25 FT. OF THE SEPTIC FIELD AREA.
10. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY LOT CORNER LOCATIONS AND EXISTENCE OF ANY EASEMENTS.
11. ALL TREES WITHIN 10 FEET OF ANY SEPTIC LATERAL SHALL BE ROOT PRUNED PRIOR TO ANY SEPTIC SYSTEM CONSTRUCTION.
12. ALL TANK MATERIALS AND DROP BOXES SHALL MEET VILLAGE STANDARDS.
13. VILLAGE SHALL BE NOTIFIED ONCE THE WELL LOCATION IS DETERMINED.
14. CLIENT OR CONTRACTOR MUST VERIFY THE TYPE & CONDITION OF ADJACENT SEPTIC SYSTEMS PRIOR TO BEGINNING ANY CONSTRUCTION. FAILURE TO VERIFY BOTH TYPE & CONDITION OF ADJACENT SEPTIC SYSTEMS WITHIN 150 FT. OF THE PROPOSED WELL SITE SHALL VOID THIS DESIGN
15. WE HIGHLY RECOMMEND THAT, PRIOR TO SUBMITTAL OF THESE PLANS FOR PERMIT, THE PARTY INTENDING TO USE THESE PLANS CAUSE ALL SEPTIC TANKS WITHIN 200 FT. OF THE SUBJECT PROPERTY TO BE PUMPED OUT & INSPECTED TO DETERMINED IF THEY ARE CESSPOOLS OR GREY-WATER TANKS. IF ANY TANK WITHIN 200 FT. OF THE PROPOSED WELL LOCATION ON THIS PLAN IS A CESSPOOL OR WITHIN 100 FT. IS FOUND TO BE A GREY-WATER TANK THESE PLANS ARE VOID UNTIL REVISED BY THE ENGINEER.
16. IT IS THE RESPONSIBILITY OF THE CLIENT TO VERIFY THAT THE PROPOSED INVERT OF THE SANITARY SEWER AS IT EXITS THE FOUNDATION IS SUITABLE TO ACCOMODATE THE INTERIOR PLUMBING OF THE BUILDING. IF THE INTERIOR PLUMBING REQUIRES AN ELEVATION LOWER THAN THAT SHOWN ON THESE PLANS, THE CLIENT MUST NOTIFY LAND TECHNOLOGY INC. IMMEDIATELY AND THESE PLANS ARE VOID UNTIL REVISED.

N
W E
S

SCALE:
1"=30'

JULIE
1-800-892-0123
Call 48 hours before you dig (Excluding Sat., Sun.(Holidays)

RESIDENTIAL/COMMERCIAL/INDUSTRIAL
CIVIL ENGINEERING AND LAND SURVEYING SERVICES
Land Technology, inc.
3922 W. MAIN STREET McHENRY, IL. 60050
P: (815)363-9200 F: (815)363-9223
E: LANDTECH@LANDTECHNOLOGYINC.COM
ILLINOIS PROFESSIONAL DESIGN FIRM No. 184-001331

SEPTIC/SITE PLAN:

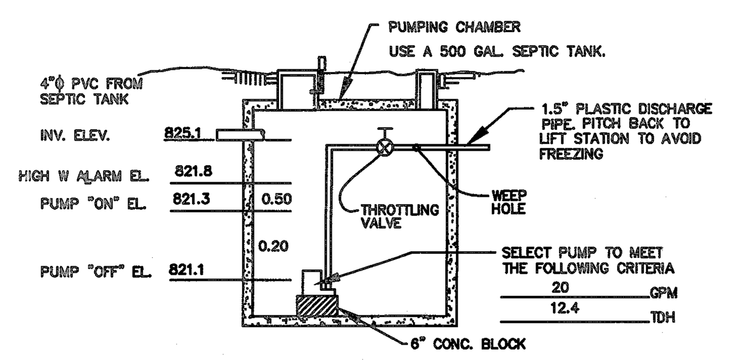
11 PERAINO CIRCLE, BARRINGTON HILLS
LOT 5 BARRINGTON RIDGE U-1
PIN: 13-33-301-014
CLIENT: MURPHY

REVISIONS:

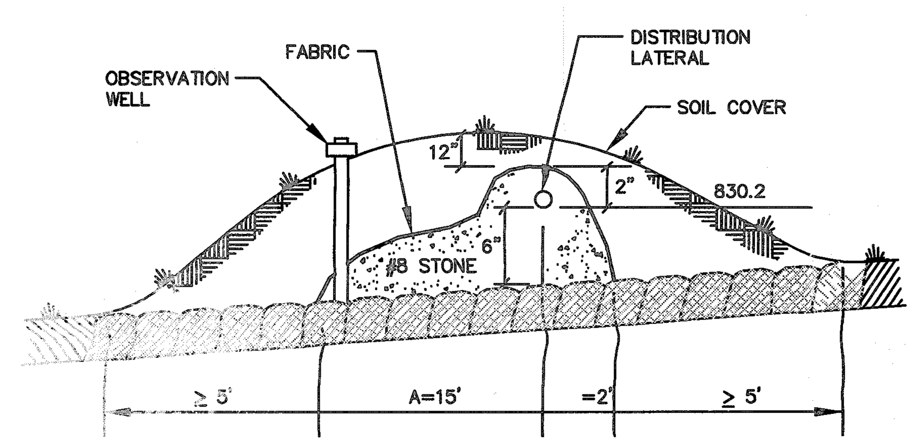
NATALIE P. KARNEY 062-33482 REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS
EXPIRES 11/30/13

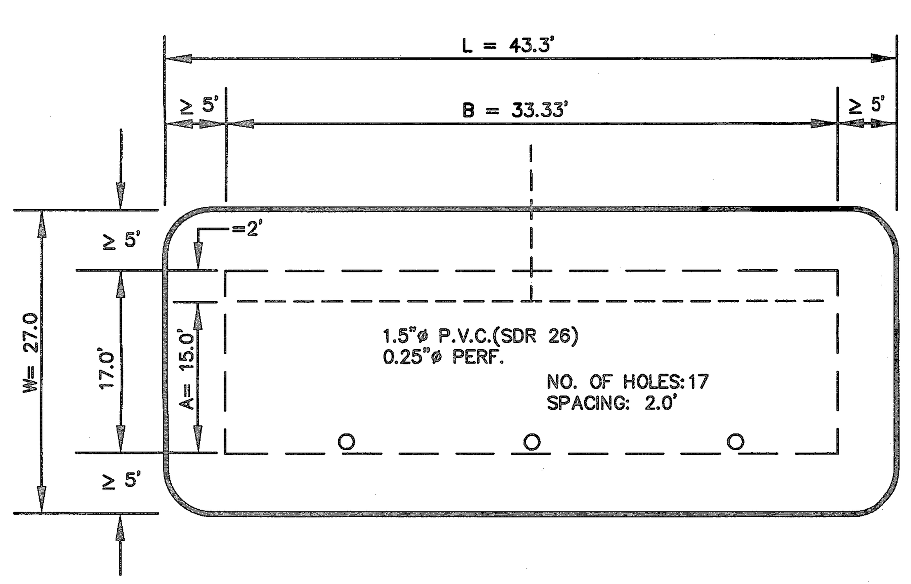
DRAWN BY: NPK
CHCK'D BY: SRS
I:\2013\13168\SEPTIC 10-9-14.dwg
DATE: 10/9/14

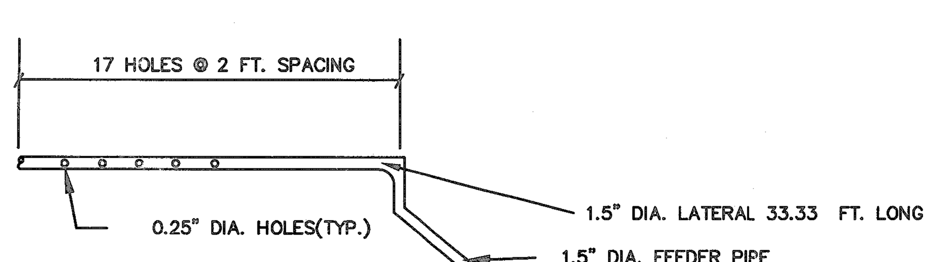
DRAWING NUMBER:
13-168



LIFT STATION DETAIL
(NO SCALE)







PLUMBING ISOMETRIC
SECTION A–A

SPECIAL NOTE:
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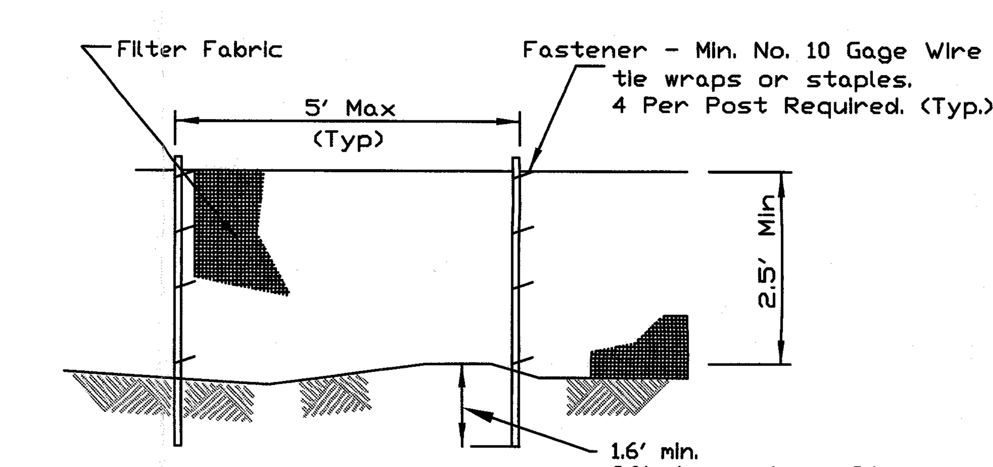
GENERAL SEEDING SPECIFICATIONS:

All disturbed soil shall immediately be graded and seeded as follows:

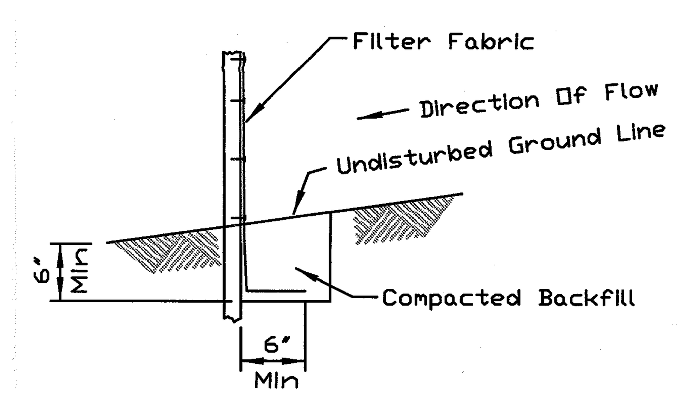
1) Scarify subsoil to a depth of 4".
2) Spread topsoil 4" thick.
3) Fertilize w/N,P205&k20.
4) Final Raking
5) Seed Application
6) Apply straw @ 2 Tons/Acre.
7) All slopes over 5:1–Place 1" x 2" Nylon mesh over straw–staple in place
8) PERMANENT SEEDING
a) Fertilize @ 130#/Ac. each
b) Seed w/KENTUCKY BLUEGRASS @ 90#/ac. AND PERENNIAL RYEGRASS @ 40#/ac.
9) TEMPORARY SEEDING
a) Fertilize @ 60#/Ac. each
Seed w/Cerea Rye @ 300#/Ac. Oats @ 300#/Ac. & Perennial Rye @30#/Ac.
10) DORMANT SEEDING (Nov. 1 – Mar.15)
a) Increase seeding Application by 50%

NOTES:

1) All disturbed areas (except those to be paved) shall have temporary seed and mulch applied immediately following rough grading.
2) The owner shall be totally responsible for erosion control and detention measures before, during and after construction.
3) Erosion control and construction shall conform with standards set forth by the "Illinois Procedures and Standards for Urban Soil Erosion and Sedimentation Control" manual, latest edition (rev. July, 1988).
4) Dust & Traffic Control
It shall be the responsibility of the developer to minimize dust blowing from the construction site. If dust begins blowing from the site all roadways shall be treated with a dust control binder (Curasol Terratack or equal). Apply as needed according to manufacture's directions.
5) Barrier Filter Placement Detail:
a) Maintain detention Barrier Filters and all Swale and Structure Filters until an acceptable stand of grass is established upstream.
b) After removal of Filters, place sod around structures.



ELEVATION



FABRIC ANCHOR DETAIL

Installation Requirements
- All materials and the installation process must conform with AASHTO - 288-00 standards
- Posts to be:
  - Wood, steel or synthetic
  - Minimum length of 3.2 ft. + burial depth
    - Bury 1.6 ft.on slopes less than 3:1
    - Bury 2.0 ft. on slopes 3:1 or greater
- Post dimensions
  - Hardwood = 1.2" x 1.2"
  - Pine = 2.6" x 2.6"
  - Steel = U,T,L, or C shape, weighing 1.3 lbs / ft.
- Fabric buried in a "J" configuration to a minimum depth of 5.9" in a trench
  - Trench to be backfilled and compacted

SILT FENCE DETAIL

RESIDENTIAL/COMMERCIAL/INDUSTRIAL
CIVIL ENGINEERING AND
LAND SURVEYING SERVICES
Land Technology,inc.
3922 W. MAIN STREET McHENRY, IL. 60050
P: (815)363-9200 F: (815)363-9223
E: LANDTECH@LANDTECHNOLOGYINC.COM
ILLINOIS PROFESSIONAL DESIGN FIRM
No. 184-001331

DETAILS:
11 PERAINO CIRCLE, BARRINGTON HILLS
LOT 5 BARRINGTON RIDGE U-1
PIN: 13-33-301-014
CLIENT: MURPHY

REVISIONS:

NATALIE P. KARNEY
062-33482
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS
EXPIRES 11/30/13

DRAWN BY:	NPK
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GEWALT HAMILTON ASSOCIATES, INC.
CONSULTING ENGINEERS
625 Forest Edge Drive, Vernon Hills, IL 60061
Tel 847.478.9700 ■ Fax 847.478.9701
www.gha-engineers.com

Memorandum

To: Trustee Michael Harrington, Insurance, Health, Environment Buildings & Grounds Chair
Village of Barrington Hills

From: Dan Strahan
Gewalt Hamilton Associates, Inc.

Date: January 23, 2015

Re: Village Hall Groundwater Testing
Level II Test Results

On January 21, 2015 the Village received analytic results for the sample of water collected at the Village Hall. The testing was completed by the Illinois State Water Survey (ISWS) and included ten separate tests for 26 water quality parameters. GHA has reviewed the results and also sent them to the Water Quality Association (WQA) for review as well. We offer the following observations:

- As expected, the sample indicated high levels of iron in the water. The IEPA has established a secondary maximum contaminant level (SMCL, established for parameters that affect aesthetic problems such as unpleasant taste or odors but do not cause health problems) at 0.3 mg/L. The concentration of iron in the sample was found to be 0.824 mg/L. Elevateed iron levels can cause a rusty color, metallic taste, and staining of fixtures.
- The ISWS characterized the sample as “moderately mineralized and hard”; the representative from the Water Quality Association characterized it as “very hard”. The hardness level was found to be 278 mg/L as $CaCO_3$. Water hardness can cause internal plumbing issues.
- The only other parameter noted by the WQA is strontium, for which the IEPA has set a health reference level of 1.5 mg/L. The representative of the WQA noted that the final MCL has not yet been published for strontium but the concentration of 1.2 mg/L found in the sample is close to the health reference level. Strontium is naturally occurring but is of concern because of its bone and skeletal effects.
- The remaining parameters tested were all well within established maximum contaminant levels.

The elevated levels of iron and hardness are not indicative of health risks but both can cause issues with internal plumbing and result in undesirable tastes. The Village may wish to consider installation of a water softener which would address these concerns and would also lower the level of strontium in the water at the Village Hall.

cc: Robert Kosin, Village Administrator

ILLINOIS STATE
WATER SURVEY
PRAIRIE RESEARCH INSTITUTE

2204 Griffith Drive • Champaign, IL 61820
T 217-333-2210 • F 217-333-4983
www.isws.illinois.edu

January 13, 2015

Mr. Robert Kosin
112 Algonquin Road
Barrington Hills, IL 60010-5199

Dear Mr. Kosin:

We are enclosing a copy of the analysis made on a sample of water collected from a well owned by Village of Barrington Hills in Cook County. Relevant sample number is: 237859.

The analysis shows this sample to be moderately mineralized and hard. The iron content of this water is at a level which can result in the staining of porcelain and laundry. A major portion of the turbidity in this sample appears to be due to the previously soluble iron which oxidized and became insoluble after the water was exposed to air. The hardness in this sample is sufficient to cause the formation of a moderate amount of scale in hot water heaters, and to increase consumption of soap when used for washing or laundry purposes.

The arsenic content of this sample is well below the Federal Maximum Contaminant Level of 10 µg/L. The nitrate (as N) content of this sample is well below the Federal Maximum Contaminant Level of 10 mg/L.

None of the other parameters tested appear unusual or excessive for Illinois ground water. However, our laboratory is only capable of identifying a limited number of the contaminants found in the Safe Drinking Water Act. Testing for bacteria, radionuclides, and synthetic organic contaminants, if desired, must be arranged through other laboratories. A listing of such laboratories can be found at www.epa.state.il.us/well-water/list-accredited-labs.html or in your yellow pages under "water".

If we can be of further assistance, please let us hear from you.

Sincerely,

Daniel L. Webb

Daniel L. Webb
Lab Supervisor, Chemistry & Technology Section
217/244-0625

jt

cc: BACOG

The analytical methods used for the samples are as follows:

US EPA 200.7, Revision 4.4: Metals and Trace Elements by Inductively Coupled Argon Plasma-Atomic Emission Spectrometry:

iron, Fe	sodium, Na	nickel, Ni	beryllium, Be
manganese, Mn	barium, Ba	copper, Cu	potassium, K
calcium, Ca	boron, B	zinc, Zn	
magnesium, Mg	chromium, Cr	aluminum, Al	

US EPA Method 300.0, Revision 2.1: Inorganic anions by Ion Chromatography

chloride, Cl nitrate, NO_3-N sulfate, SO_4 fluoride, F

US EPA Method 200.9: Trace Elements by Graphite Furnace Atomic Absorption Spectrometry

arsenic, As lead, Pb

US EPA Method 150.1: pH, Electrometric

SM19, 2320-B: Alkalinity, electrometric titration, mg/L as $CaCO_3$

SM18,2540-C: Total Dissolved Solids Dried at 180°C

US EPA Method 180.1: Turbidity by Nephelometry

Hach Method 8025: Color, Platinum-Cobalt Standard Method

SM18,2150-B: Odor, Threshold Odor Test

SM18,2340-B: Hardness by Calculation

ILLINOIS STATE
WATER SURVEY
PRAIRIE RESEARCH INSTITUTE

2204 Griffith Drive • Champaign, IL 61820
T 217-333-2210 • F 217-333-4983
www.isws.illinois.edu

WATER SAMPLE DATA
LABORATORY SAMPLE NUMBER: 237859

SOURCE: PRIVATE WELL
WELL#:
LOCATION: BARRINGTON HILLS
COUNTY: COOK
TOWNSHIP: 42N
RANGE: 09E
SECTION: 16
PLOT:
TREATMENT:

OWNER: BILLAGE OF BARRINGTON HILLS
WELL DEPTH:
DATE COLLECTED: 12/8/2014
DATE RECEIVED: 12/10/2014
FIELD TEMPERATURE (F): ND
COMMENTS: SAMPLE COLLECTED FROM KITCHEN SINK COLD WATER TAP. PAGE 3 OF 3.

PARAMETER		RESULT	UNITS
Iron (Total Fe):		0.824	mg/L
Potassium (K):		4.22	mg/L
Calcium (Ca):		48.2	mg/L
Magnesium (Mg):		38.3	mg/L
Sodium (Na):		28.9	mg/L
Aluminum (Al):	<	37	µg/L
Arsenic (As):	<	0.95	µg/L
Barium (Ba):		86.3	µg/L
Beryllium (Be):	<	0.55	µg/L
Boron (B):		368	µg/L
Chromium (Cr):	<	5.8	µg/L
Cobalt (Co):	<	13	µg/L
Copper (Cu):		3.4	µg/L
Lithium (Li):	<	110	µg/L
Manganese (Mn):		5.8	µg/L
Molybdenum (Mo):	<	22	µg/L
Nickel (Ni):	<	43	µg/L
Strontium (Sr):		1201	µg/L
Tin (Sn):	<	86	µg/L
Titanium (Ti):	<	0.56	µg/L
Vanadium (V):	<	47	µg/L
Zinc (Zn):		301	µg/L

PARAMETER		RESULT	UNITS
Fluoride (F):		0.65	mg/L
Chloride (Cl):		2.01	mg/L
Nitrate (NO3-N):	<	0.04	mg/L
Phosphorus (P):	<	0.073	mg/L
Sulfate (SO4):		3.46	mg/L
Sulfur (S):		1.26	mg/L
Turbidity (Lab, NTU):		9.6	NTU
Color (PCU):	<	5	PCU
pH (Lab):		7.84	
Alkalinity (CaCO3):		324	mg/L
Hardness (as CaCO3):		278	mg/L
Silica (SiO2):		18.6	mg/L
Total Dissolved Solids:		320	mg/L
Non-Volatile Org. Carbon (Tot., as C):		0.85	mg/L

< = Below detection limit (i.e. < 1.0 = less than 1.0)
mg/L = milligrams per liter
ND = Not determined/Information not available
ug/L = micrograms per Liter
hardness = (Ca mg/L * 2.497) + (Mg mg/L * 4.118)
1 mg/L = 1000 ug/L

Analyzed by: Omar Ali, Rita Bargon, Tanya Grandt, Ruth Ann Nichols, Kaye J Surratt, and Daniel L Webb

ILLINOIS STATE
WATER SURVEY
PRAIRIE RESEARCH INSTITUTE

UNDERSTANDING YOUR WATER QUALITY ANALYSIS

Having your well water tested is an important step to ensure safe drinking water. The U.S. Environmental Protection Agency establishes drinking water standards, such as maximum contaminant levels (MCL) and secondary maximum contaminant levels (SMCL), and public water supplies are required to test their water routinely for a list of regulated contaminants. For private well owners, however, water testing is their responsibility. The following guide is intended to help customers understand the results of their water quality analysis.

Analyte	Description	MCL (or SMCL, if noted)	Source	Websites (for more information)
Alkalinity	Measure of bicarbonate, carbonate, or hydroxide constituents; not detrimental to humans; IDPH recommends 30-400 mg/L for drinking water.		IDPH	http://www.idph.state.il.us/envhealth/pdf/DrinkingWater.pdf
Aluminum	Above the SMCL may result in colored water.	0.05 to 0.2 mg/L	US EPA	http://water.epa.gov/drink/contaminants/secondarystandards.cfm
Arsenic	Naturally occurring in some groundwater throughout Illinois. EPA indicates some people who drink water containing arsenic in excess of the MCL for many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer.	0.010 mg/L (=10 µg/L)	ISWS	http://www.isws.illinois.edu/gws/archive/arsenic/ilsources.asp
			US EPA	http://water.epa.gov/drink/contaminants/index.cfm
Barium	Naturally occurring, possible discharge of drilling wastes and metal refineries; erosion of natural deposits. Some people who drink water containing barium in excess of the maximum contaminant level (MCL) for many years could experience an increase in their blood pressure.	2 mg/L	US EPA	http://water.epa.gov/drink/contaminants/index.cfm
				http://water.epa.gov/drink/contaminants/basicinformation/barium.cfm
Beryllium	Naturally enters water through the weathering of rocks and soils or from industrial wastewater discharges. Some people who drink water containing beryllium in excess of the maximum contaminant level (MCL) for many years could develop intestinal lesions.	0.004 mg/L (=4 µg/L)	US EPA	http://water.epa.gov/drink/contaminants/index.cfm
				http://water.epa.gov/drink/contaminants/basicinformation/beryllium.cfm
Calcium	(See hardness)			
Chloride	Naturally occurring; runoff from road deicing; pollution from brine or industrial or domestic wastes; high levels can cause salty taste and be corrosive to iron pipe.	SMCL = 250 mg/L	IDPH	http://www.idph.state.il.us/envhealth/pdf/DrinkingWater.pdf
			US EPA	http://water.epa.gov/drink/contaminants/secondarystandards.cfm
Chromium	Found naturally in rocks, plants; most common forms of chromium that occur in natural waters are trivalent chromium (chromium-3), and hexavalent chromium (chromium-6). Chromium-3 is a nutritionally essential element in humans and is often added to vitamins as a dietary supplement. Chromium-3 has relatively low toxicity and would be a concern in drinking water only at very high levels of contamination; Chromium-6 is more toxic and poses potential health risks (allergic dermatitis, possibly carcinogenic).	0.1 mg/L	US EPA	http://water.epa.gov/drink/contaminants/index.cfm
Color	Visible tint in the water (yellow/tan/brown); can be caused by decaying vegetation.	SMCL = 15 units	US EPA	http://water.epa.gov/drink/contaminants/secondarystandards.cfm
Copper	Short-term = gastrointestinal distress, and with long-term exposure may experience liver or kidney damage. Treatment technique regulation-action level 1.3 mg/L; SMCL = 1.0 mg/L (above SMCL = metallic taste; blue-green staining)	1.3 mg/L; 1.0 mg/L	US EPA	http://water.epa.gov/drink/contaminants/basicinformation/copper.cfm
Fluoride	Commonly added to community supplies (to 1 mg/L) to promote dental health. Excessive consumption over a lifetime may lead to increased likelihood of bone fractures in adults, and may result in effects on bone leading to pain and tenderness. Children may have an increased chance of developing pits in the tooth enamel, along with a range of cosmetic effects to teeth. EPA has both an MCL and a SMCL.	4 mg/L	US EPA	http://water.epa.gov/drink/contaminants/index.cfm
		SMCL = 2 mg/L	US EPA	http://water.epa.gov/drink/contaminants/secondarystandards.cfm

Analyte	Description	EPA MCL or SMCL	Source	Websites (for more information)
Hardness	Generally caused by calcium and magnesium minerals. Affects consumption of soap; causes scale. Generally removed using a water softener. Calcium can form scale when heated. IDPH: The following is a measure of hardness (expressed in mg/L as calcium carbonate): 0 - 100 Soft 100 - 200 Moderate 200 - 300 Hard 300 - 500 Very hard 500 - 1,000 Extremely hard May also be expressed in grains per gallon. The conversion formula is: 1 gpg = 17.1 mg/L.		ISWS	http://www.isws.uiuc.edu/pubdoc/C/ISWSC-118.pdf
			IDPH	http://www.idph.state.il.us/envhealth/pdf/DrinkingWater.pdf
Iron	Naturally occurring as soluble Iron (II), but oxidizes to Iron(III); rusty color; sediment; metallic taste; reddish or orange staining; removed by physical filtration, iron filter, water softener	SMCL = 0.3 mg/L	IDPH	http://www.idph.state.il.us/envhealth/factsheets/ironFS.htm
			IDPH	http://www.idph.state.il.us/envhealth/pdf/DrinkingWater.pdf
			US EPA	http://water.epa.gov/drink/contaminants/secondarystandards.cfm
Magnesium	(See hardness)			
Manganese	Naturally occurring; black to brown color; black staining; bitter metallic taste	SMCL = 0.05 mg/L	US EPA	http://water.epa.gov/drink/contaminants/secondarystandards.cfm
Nickel	No current EPA limit; has potential to cause the following health effects from long-term exposure at levels above the MCL: decreased body weight; heart and liver damage; dermatitis.	Old MCL = 0.1 mg/L	US EPA	http://www.epa.gov/ogwdw/pdfs/factsheets/ioc/tech/nickel.pdf
Nitrate	Often used in fertilizer. Infants below six months who drink water containing nitrate in excess of the maximum contaminant level (MCL) could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome (methemoglobinemia).	10 mg/L as N	US EPA	http://water.epa.gov/drink/contaminants/basicinformation/nitrate.cfm
pH	Low pH: bitter metallic taste; corrosion high pH: slippery feel; soda taste; deposits desirable range = 6.5-8.5	SMCL = 6.5-8.5	US EPA	http://water.epa.gov/drink/contaminants/secondarystandards.cfm
			IDPH	http://www.idph.state.il.us/envhealth/pdf/DrinkingWater.pdf
Sodium	No curent federal drinking water standard; high levels may be associated with hypertension in some individuals, but typically the majority of sodium ingestion is from food rather than drinking water. Water softening will increase sodium.		US EPA	http://water.epa.gov/scitech/drinkingwater/dws/ccl/sodium.cfm
Sulfate	Naturally occurring; high levels can cause laxative effect, especially if changing from water supply with low sulfates. Coal mining can contribute. IDPH states: 0-250 mg/L=acceptable; 250-500 mg/L=can be tolerated; 500-1000 mg/L=undesirable; over 1000 mg/L=unsatisfactory	SMCL = 250 mg/L	ISWS	http://www.isws.uiuc.edu/pubdoc/C/ISWSC-118.pdf
			IDPH	http://www.idph.state.il.us/envhealth/pdf/DrinkingWater.pdf
			US EPA	http://water.epa.gov/drink/contaminants/unregulated/sulfate.cfm
Total Dissolved Solids	Measure of the total amount of dissolved minerals/substances in water; high levels may cause salty taste IDPH states: less than 500 mg/L= satisfactory; 500 - 1000 mg/L= less than desirable; 1000-1500 mg/L= undesirable; over 1500 mg/L= unsatisfactory	SMCL = 500 mg/L	US EPA	http://water.epa.gov/drink/contaminants/secondarystandards.cfm
			IDPH	http://www.idph.state.il.us/envhealth/pdf/DrinkingWater.pdf
Turbidity	Turbidity refers to cloudiness of water. Often due to sand, silt, clay, or precipitated iron (see also iron). Turbidity has no health effects, but can be an indication of the presence of disease-causing organisms.	n/a. See EPA website for info	US EPA	http://water.epa.gov/drink/contaminants/index.cfm
Zinc	Metallic taste	SMCL = 5 mg/L	US EPA	http://water.epa.gov/drink/contaminants/secondarystandards.cfm

Notes:

MCL = Maximum Contaminant Level (Set by US EPA and is generally the maximum level allowed for public water systems)
SMCL = Secondary Maximum Contaminant Level (non-mandatory guidelines for aestheic considerations; generally analyte is not considered a risk to human health)
US EPA = United States Environmental Protection Agency
IDPH = Illinois Department of Public Health
mg/L = milligrams per liter; this is the same as parts per million (ppm)
µg/L = micrograms per liter; this is the same as parts per billion (ppb)
List of all EPA drinking water contaminants: http://water.epa.gov/drink/contaminants/index.cfm

ISWSC-185; 01/2013; D. Webb, G. Czapar

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MEMORANDUM

To: Robert Kosin, Village of Barrington Hills
Board of Health Members

From: Daniel J. Strahan, P.E., CFM
Gewalt Hamilton Associates

Date: February 5, 2105

Re: Level II Groundwater Testing Program Update

Based on discussions at the January meeting of the Board of Health, our office has reviewed the logistics for the proposed groundwater quality testing program. It is understood that the Board of Health wishes to pursue annual groundwater testing for approximately 10 locations (including the Village Hall). There are a few different options to accomplish this goal:

- **Option 1- ISWS Testing thru BACOG**: BACOG currently arranges for testing of 8 samples per month through the Illinois State Water Survey. This is the lowest cost option at $50 per sample which would include a sample before and after the water softener where one exists. The samples are taken and delivered one day per month, so coordination would be required with BACOG and the various facilities to schedule the tests. BACOG currently has a lengthy waiting list of residents wishing to utilize this program, so it may not be feasible to conduct annual testing through this program.
- **Option 2- Kane/Dupage Soil & Water Conservation District:** Kane-Dupage SWCD has a private well testing program that would test a similar set of parameters for $135. Their program runs through the National Center for Water Quality Research at Heidelberg University in Ohio. The testing lab is not certified by IEPA.
- **Option 3- McHenry Analytical Lab:** This is a private testing facility in McHenry that is certified by the IEPA. Based on the set of parameters provided the quote given was $299 per sample.

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MEMORANDUM

To: Robert Kosin, Village of Barrington Hills
Board of Health Members

From: Daniel J. Strahan, P.E., CFM
Gewalt Hamilton Associates

Date: February 5, 2105

Re: Groundwater Aging

Through the groundwater research conducted by BACOG and others, it is understood that the shallow aquifers that provide drinking water to the Village of Barrington Hills are recharged locally, generally within a few thousand feet of the well that draws from it. For a variety of reasons, it is of interest to know the rate at which surface water infiltrates the ground and reaches the shallow aquifer. Geological data has been utilized to project recharge times that vary widely. In some areas groundwater reaches the aquifer almost instantaneously, while in others the recharge time can take years or even decades.

The attached document from the United States Geologic Survey details a method of dating groundwater based on various “environmental tracers”. One such tracer is tritium, a hydrogen isotope present in water vapor. Nuclear testing in the 1950’s and 60’s greatly increased the background atmospheric levels of tritium. These levels have fallen at a measurable rate since such testing ended. As a result, the level of tritium present within a groundwater sample can provide an indication of when that water was last in contact with the atmosphere. Tritium testing alone is somewhat limited in that it can determine if a sample is “modern” (less than 50 years old) or “pre-modern” (older than 50 years old). When paired with Helium-3 testing an apparent age can be determined.

A testing facility has been located in Champaign, IL that conducts testing for tritium. Sampling costs range from $250-$400 depending on the acceptable detection limits. However, this lab does not perform Helium-3 testing, so only a qualitative analysis could be done. Further research could be pursued to find a testing facility that performs both test for a more precise “aging” process if this course of action is perceived to be of value to the Board.

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Tracing and Dating Young Ground Water

Data on concentrations of environmental tracers, such as chlorofluorocarbons (CFCs), tritium (^3H), and other chemical and isotopic substances in ground water, can be used to trace the flow of young water (water recharged within the past 50 years) and to determine the time elapsed since recharge. Information about the age of ground water can be used to define recharge rates, refine hydrologic models of ground-water systems, predict contamination potential, and estimate the time needed to flush contaminants from ground-water systems. CFCs also can be used to trace seepage from rivers into ground-water systems, provide diagnostic tools for detection and early warning of leakage from landfills and septic tanks, and to assess susceptibility of water-supply wells to contamination from near-surface sources.

During the past 50 years, human activities have released an array of chemical and isotopic substances to the atmosphere. In the atmosphere, these substances have mixed and spread worldwide. These atmospheric substances, such as tritium (^3H) in water vapor from detonation of nuclear bombs in the 1950s and early 1960s,and chlorofluorocarbons (CFCs) from refrigeration and other uses from the 1950s through the 1980s, dissolve in precipitation, become incorporated in the Earth's hydrologic cycle, and can be found in ground water that has been recharged within the past 50 years. The detection of chlorofluorocarbons and tritium in ground water provides valuable information that can be used for dating and tracing young ground water—techniques that help water-resources managers develop management strategies for shallow ground-water systems.

Young ground water in shallow ground-water systems

Young ground water is typically found at depths from 0 to 100 feet in unconsolidated sediments and at depths up to 1000 feet in fractured-rock systems. Shallow ground-water systems are commonly used for drinking water sources and they make up a large part of the baseflow in rivers and lakes. However, shallow ground-water supplies are generally young (recently recharged) and, because there has been a wide variety of man-made pollutants produced in the 20th century, are more susceptible to contamination than deeper ground water. Information about ground-water age can be used to determine recharge rates and refine hydrologic models of ground-water systems (Reilly and others, 1994; Szabo and others, 1996) and thus to predict the contamination potential and estimate the time needed to flush contaminants through a ground-water system.

The 0- to 50-year time scale is particularly relevant to environmentally sensitive shallow ground-water systems. Prior to the late 1980s, however, there were no reliable means of dating ground water recharged during this time scale and, until recently, none of those methods were considered practical for use in establishing regional patterns. In the early 1990s, USGS scientists (Busenberg and Plummer, 1992) developed a method to date ground water on the basis of chlorofluorocarbon (CFC) content of the water that is practical, cost-effective, and applicable to most shallow ground-water systems.

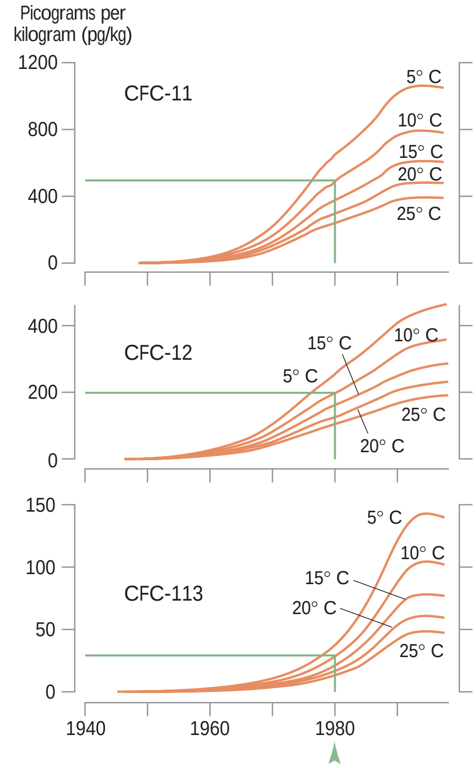
Sampling for tracers

The feasibility of using CFCs as tracers of recent recharge and indicators of ground-water age was first recognized in the 1970s (see Plummer and Busenberg, 1997 and references therein). CFCs have been increasingly used in oceanic studies since the late 1970s as tracers of oceanic circulation, ventilation, and mixing processes. USGS scientists (Busenberg and Plummer, 1992) adapted analytical procedures developed by the oceanographic scientific community for ground-water studies and designed sampling equipment and procedures for collection and preservation of water samples in the field. Water samples for CFC analysis are now routinely collected from domestic, irrigation, monitoring, and municipal wells, and from springs. A closed path is established

USGS Hydrologist collects a water sample for CFC analyses from a domestic well in south-central Idaho.

USGS Hydrologist analyzes a water sample for CFCs at the USGS Chlorofluorocarbon Laboratory, Reston, Virginia.

Chlorofluorocarbons are stable, synthetic organic compounds that were developed in the early 1930s as safe alternatives to ammonia and sulfur dioxide in refrigeration and have been used in a wide range of industrial and refrigerant applications. Production of CFC-12 (dichlorodifluoromethane, CF_2Cl_2) began in 1931, followed by CFC-11 (trichlorofluoromethane, $CFCl_3$) in 1936, and then by many other CFC compounds, most notably CFC-113 (trichlorotrifluoroethane, $C_2F_3Cl_3$). CFC-11 and CFC-12 were used as coolants in air conditioning and refrigeration, blowing agents in foams, insulation, and packing materials, propellants in aerosol cans, and as solvents. CFC-113 has been used primarily by the electronics industry in semiconductor chip manufacturing, in vapor degreasing and cold immersion cleaning of microelectronic components, and surface cleaning. Probably better known to the public as Freon™, CFCs are nontoxic, nonflammable and noncarcinogenic, but they contribute to ozone depletion. Therefore in 1987, 37 nations signed an agreement to limit release of CFCs and to halve CFC emissions by 2000. This agreement, the Montreal Protocol on Substances That Deplete the Ozone Layer, was strengthened in 1990 and again in 1992 when 1996 was established as the cut-off date for CFC production in industrialized countries. Production of CFCs ceased in the United States as of January 1, 1996, under the Clean Air Act. Current estimates of the atmospheric lifetimes of CFC-11, CFC-12, and CFC-113 are about 45, 87, and 100 years, respectively.

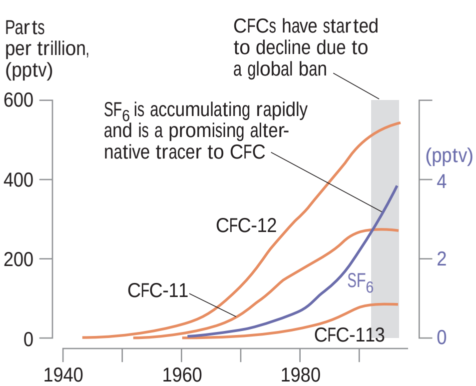


Concentrations of CFC-11, CFC-12, and CFC-113 in water recharged in equilibrium with air between the years 1940 and 2000 at temperatures of 5 to 25°C. The CFC analysis determined that concentrations of CFC-11, CFC-12 and CFC-113 were 493, 203, and 28 pg/kg in the water sample to be dated. The recharge temperature of 10°C was determined from analysis of dissolved nitrogen and argon in the water sample.

between the well or pump to a valve system that is used to fill glass ampoules with water, creating a headspace with CFC-free, ultra-pure nitrogen gas. The samples are then transported to the U.S. Nuclear Regulatory Commission-licensed USGS laboratory for analysis of CFC content by gas chromatography to a detection limit of about 0.3 picograms per kilogram (0.3 pg/kg) of water, which is equivalent to 0.3×10^{-12} grams per kilogram, or 0.3 parts per quadrillion.

Determining ground-water ages

Ground-water dating with CFC-11, CFC-12 and CFC-113 is possible because (1) their amounts in the atmosphere over the past 50 years have been reconstructed, (2) their solubilities in water are known,



CFCs and sulfur hexafluoride (SF_6) concentrations (mixing ratios) for air over North America during the last 50 years.

and (3) concentrations in air and young water are high enough that they can be measured. Age is determined from CFCs by relating their measured concentrations in ground water back to known historical atmospheric concentrations and/or to calculated concentrations expected in water in equilibrium with air. As with any environmental tracer, age applies to the date of introduction of the chemical substance into the water, and not to the water itself. The accuracy of the determined age depends in part on how perfectly the CFCs are transported with the water. Chemical processes, such as microbial degradation and sorption during transit, can also affect the concentration of CFCs and other compounds used in dating. For this reason, the term "age" is normally qualified with the word "model" or "apparent," that is, "model age" or "apparent age."

USGS scientists have investigated some of the most important factors that can affect CFC concentrations in ground water and the resulting age interpretations (Busenberg and Plummer, 1992; Plummer and others, 1993; Dunkle and others, 1993; Ekwurzel and others, 1994; Cook and others, 1995; Plummer and others 1998a, 1998b; Plummer and Busenberg, 1999). These include (1) uncertainty of the temperature at the water table during recharge, (2) entrapment of excess air during recharge, (3) uncertainty in recharge elevation, (4) thickness of the unsaturated zone, (5) effect of urban air where CFC values may exceed regional values, (6) contamination from a specific local source, (7) microbial degradation (in anaerobic environments), (8) sorption onto organic and mineral surfaces, and (9) mixing of younger and older water in a well. Because of the effect of these factors on CFC concentration, collection of additional data is often needed to determine the apparent age of ground water. For example, measurements of concentrations of dissolved gases, such as dissolved oxygen, help to define the potential for microbial degradation. Measurements of dissolved methane are useful in recognizing environments where all three CFCs can be degraded. Measurements of dissolved nitrogen and argon can be used to help determine recharge temperature and excess air and to recognize environments undergoing denitrification.

Other chemical dating tools

Tritium (half-life 12.4 years) provides another useful tracer of young ground water. Although it is difficult to evaluate age information from tritium data alone, age commonly can be reliably determined from data on tritium (^3H) and its decay product, helium-3 (^3He). The $^3H/^3He$ age is based on a calculation that determines the amount of ^3He derived from radioactive decay of ^3H in the water. Several conditions are necessary to solve the calculation and interpret the age: (1) The sample must contain detectable ^3H (greater than approximately 0.5 tritium unit, or TU, which is defined as one ^3H atom in 10^{18} hydrogen atoms) and (2) if the sample contains terrigenic helium from the Earth's crust and mantle sources, the relative abundances of helium-3 and helium-4 isotopes in the terrigenic helium must be known, and data on dissolved neon concentrations in the sample are needed to help determine how much helium-3 is derived from tritium decay. Water samples for $^3H/^3He$ age determination can be collected more easily than those for CFC determination, but are more difficult and costly to analyze than CFC samples.

Krypton-85 (^{85}Kr) has also been used to date ground water. The source for atmospheric input of ^{85}Kr is reprocessing of fuel rods from nuclear reactors. Because of difficulties in collection and analysis, ^{85}Kr is not yet a practical dating tool for ground-water studies. In CFC-contaminated environments, or environments where methane is forming from microbial degradation of organic matter, noble-gas dating techniques such as those based on $^3H/^3He$ and ^{85}Kr measurements may be the only techniques for dating. However, because of their low detection limit and low sensitivity to hydrodynamic dispersion, CFCs can be more reliable than $^3H/^3He$ and ^{85}Kr dating for waters recharged in the late 1940s and 1950s.

Seeking alternatives to CFC dating

Alternatives to using CFCs in dating ground water will clearly be needed as atmospheric CFC concentrations continue to fall. The use of sulfur hexafluoride (SF_6) appears to be a promising technique and is under investigation by USGS scientists (Busenberg and Plummer, 1997; Plummer and Busenberg, 1999). Industrial production of SF_6 began in 1953 with the introduction of gas-filled high-voltage electrical switches. SF_6 is extremely stable and is accumulating rapidly in the atmosphere. The historical atmospheric mixing ratio of SF_6 is being reconstructed from production records, archived air samples, and atmospheric measurements, and retrieved from concentrations measured in seawater and in previously-dated ground water. A preliminary reconstruction has been made of northern-hemisphere SF_6 mixing ratios (figure far left). As atmospheric CFC concentrations fall, an even more sensitive dating tool will be the ratio of SF_6 to, for example, CFC-12. Although SF_6 is almost entirely of human origin, there is likely a natural, igneous source of SF_6 that will complicate dating in some environments. USGS scientists have successfully used SF_6 to date shallow ground water on the Delmarva Peninsula, Maryland, and water from springs in the Blue Ridge Mountains of Virginia with SF_6.

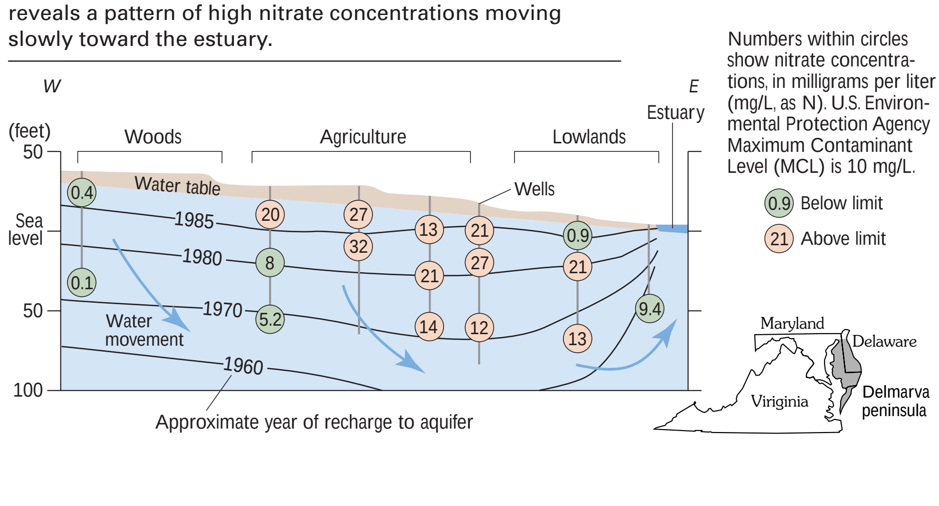
Additional comments and case studies

For best results, the apparent age should be determined using multiple dating techniques because each dating technique has limitations. CFC dating is best suited for ground water in relatively rural environments where localized contamination, such as that from septic systems, sewage effluent, landfills, or urban runoff, can contain CFC concentrations in excess of that of atmospheric sources. The dating method appears to work well in shallow, aerobic, sand aquifers that are low in particulate organic matter and the results can be accurate within 2–3 years in this type of environment. Even where there are problems with CFC dating of ground water, the presence of CFCs indicates that the water sample contains at least some post-1940s water, making CFCs useful as tracers of recent recharge. Where CFC and $^3H/^3He$ ages agree, or where all three CFCs indicate similar ages, considerable confidence can be placed in the apparent age.

Delmarva Peninsula   Results from the determination of CFCs in some agricultural areas on the Delmarva Peninsula of Maryland and Virginia indicate that water recharged since the early 1970s exceeds the U.S. Environmental Protection Agency drinking water Maximum Contaminant Level (MCL) for nitrate of 10 mg/L (as N), while water recharged prior to the early 1970s, before the heavy use of nitrogen fertilizers, does not exceed the MCL (Dunkle and others, 1992; Ekwurzel and others, 1994; Böhlke and Denver, 1995). Nitrate concentrations in ground water under woodlands were low, whereas ground water recharged under agricultural fields had nitrate concentrations that exceeded the MCL. CFC concentrations indicate that ground water now discharging to streams that drain agricultural areas of the Delmarva and then flow into the Chesapeake Bay or the Atlantic Ocean, was recharged in nearby fields in the 1960s and 1970s (Böhlke and Denver, 1995; Focazio and others, 1998). Thus, even if the application of nitrogen fertilizers to the fields stopped today, streams, rivers, and estuaries can be expected to receive increasing amounts of nitrate from ground-water discharge until the contaminated water is flushed through the system (Modica and others, 1998); up to 30 years may be needed to flush the high-nitrate water present in several small agricultural watersheds.

Central Oklahoma   Water discharged from deep (400 to 800 feet) municipal supply wells in the central Oklahoma aquifer contains CFCs (Busenberg and

CFCs and nitrate concentrations were measured between June 1989 and January 1990 on a section of the Delmarva Peninsula, in the Fairmount watershed. Ground-water dating reveals a pattern of high nitrate concentrations moving slowly toward the estuary.

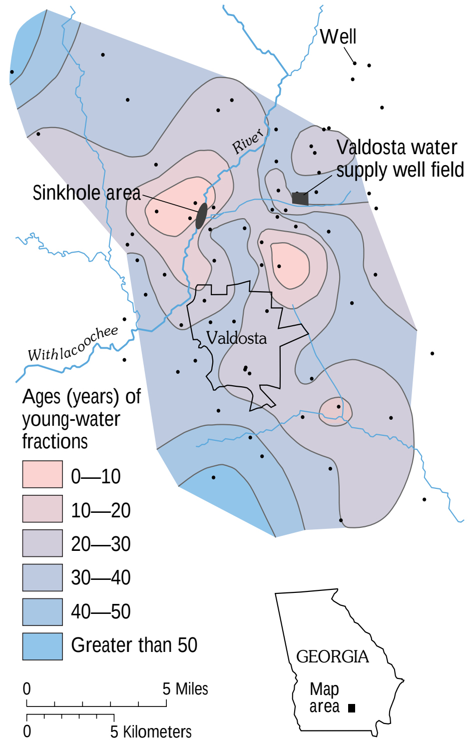


Plummer, 1992). This unexpected finding indicated that shallow ground water was being mixed with deep, older water during pumping. In this case, CFCs were a valuable tracer for testing hydraulic seals of municipal water wells and their susceptibility to contamination. River water downstream from outfalls of sewage treatment plants in central Oklahoma contained very high concentrations of CFCs, which were also found in shallow ground water in the alluvium and terrace system near rivers.

Idaho At the Idaho National Engineering and Environmental Laboratory (INEEL), the ground-water CFC concentrations were found to be in equilibrium with the shallow soil air, rather than air from the deeper unsaturated zone (Busenberg and others, 1993). This indicates that these waters passed rapidly through the unsaturated zone to the water table, rather than recharging by slow percolation. Temperatures derived from gas solubilities in ground water suggest that the aquifer is recharged locally. Ground-water velocities on the order of 6 to 24 feet per day were found in the Snake River Plain aquifer beneath the INEEL. USGS scientists (Busenberg and others, 1998) have also used CFCs in water and unsaturated zone air to trace the movement of organic waste plumes at INEEL.

Nevada Measurements of CFCs in unsaturated-zone air along the crest of Yucca Mountain, Nevada, a potential site for a high-level radioactive waste repository, show that the residence time of shallow advecting gas is less than 5 years (Thorstenson and others, 1998). Previous estimates based on carbon-14 measurements of unsaturated-zone carbon dioxide indicated a residence time of less than 40 years. In addition to decreasing the estimated travel time by an order of magnitude, the CFC data allowed gas circulation patterns in the mountain to be identified and quantified. These results are highly relevant to issues pertaining to isolation of possible repository-generated radioactive $^{14}CO_2$.

Georgia CFCs were used to trace and date leakage of river water through sinkholes into the Upper Floridan aquifer near Valdosta, Georgia (Plummer and others, 1998a, 1998b). The ages of the young-water fractions in the Upper Floridan aquifer were mapped throughout the Valdosta area. The dating indicates that few domestic and municipal supply wells produce river-water fractions that are younger than 5 years, and most river water sampled was likely recharged through the sinkholes during the past 20 to 30 years. Ground-water velocities ranged from 1 to 27 feet per day.



CFCs were used to trace and date water in the karst aquifer near Valdosta, Georgia.

Ground-water dating at Valdosta helps define the susceptibility to contamination of the ground-water resources.

—L. Niel Plummer and Linda C. Friedman

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MEMORANDUM

To: Robert Kosin, Village of Barrington Hills
Board of Health Members

From: Daniel J. Strahan, P.E., CFM
Gewalt Hamilton Associates

Date: February 5, 2015

Re: Recommended Flow Rates & Design Guidelines for Horse Boarding Operations

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At the January Board of Health meeting, the Board passed a motion requesting that our office provide recommended guidelines for reasonable flow rate for septic systems that serving residential, recreational, and commercial barns & stables. This memo considers the potential wastewater sources within horse facilities and provides recommendations for consideration of the Board regarding design flow rates as well as other design considerations.

It is noted that wastewater treatment regulations, whether for large municipal systems or individual septic systems, tend to be conservative in nature. Typical septic system design guidelines are based on 200 gallons per day per bedroom, even though it is well established that water usage in northeast Illinois tends to average 50-60 gallons per day per person. Design criteria for septic systems tend to be based on peak, “worst case scenario” uses. With regard to horse barns, good management techniques can greatly reduce the amount of wastewater produced, just as low flow and high efficiency devices in a home can greatly decrease the amount of water used in the home. From a septic design standpoint, the flow rates below assume a “worst case” scenario, consistent with other septic design guidelines, in order to minimize the potential for septic failure.

Wastewater Sources

The design of horse barns and stables in the Village of Barrington Hills varies greatly in size and complexity, ranging from simple one or two horse open-air stables to large, climate controlled facilities with dozens of stalls and indoor riding arenas. The Village has previously utilized the “Horse Facilities Handbook” as a reference standard for various planning issues pertaining to horse barns and stables of all sizes. The references notes that “Water that accumulates and drains from the stable is considered dirty water, which means it has had contact with manure or has a potential to have contact with manure. Dirty water needs to be treated before it can be released to a waterway” (Horse Facilities Handbook, 62). We would concur and recommend that horse boarding facilities be designed to include floor drainage that would route excess urine and stall wash water to a septic system for treatment as opposed to discharging to the ground surface.

In addition to floor drains, the design for a barn should be equipped to handle wastewater from any other activities within the facility that use water, such as restrooms, sinks, showers, or laundry machines. These facilities may be used by the owners of the property, employees, or visitors depending on the nature of the facility.

Recommended Design Flow Rates

We would recommend the following flow rates apply for barn facilities in Barrington Hills; rationale for each flow rate is listed below:

- 20 gpd per employee

- 5 gpd per visitor
- 15 gpd per stall
- Minimum design flow rate – 250 gpd

The Village Code currently lists a design flow rate of 15 gpd for office and other day workers; therefore, we feel that a design flow rate of 20 gpd may be a slightly conservative figure but justified based on the type of work performed compared to office settings. Typically a visitor will stay a much shorter time than an employee, so the smaller flow rate of 5 gpd per person is reasonable and consistent with the Village Code flow rate of 5 gpd per person for "places of public assembly."

The other potential source of wastewater in a barn or stable setting is floor drains. While it is typical in Barrington Hills for manure to be removed regularly and hauled off site, horse urine has a greater potential to up in floor drains unless the horse spends most of its time outside. Bedding materials are often used to absorb urine and through proper management can greatly reduce the volume that ends up in floor drains. As noted above, however, septic design criteria are conservative and typically do not take into account such water reduction measures. In addition, excess water used for washing down stalls will also end up in the wastewater flow. The flow rate given is based on typical urination of 10 gallons per day, plus an additional 5 gallons per day for wash water.

Other Guidelines

Our initial inquiry to Lake County Health Department resulted in a suggestion to include a water meter to verify usage. Given the uncertainty and variability in flow rates that would be associated with these uses, the Board may also wish to consider an option for residents to construct a septic system at a reduced size provided that a water meter is installed and usage data provided to the Village. This would allow for a reduction in the construction cost and incentivize good management practices that reduce wastewater discharges. This would also provide a data set to the Village to determine if the flow rates established are reasonable.