Minutes of Wayland SWQC Meeting, 11 May, 2011

Prepared by Bob Goldsmith

Present: Mike Lowery, Bob Goldsmith, Lin Bradford. Tom Largy (arrived late)

These minutes include several attachments of data discussed at the hearing or presented recently by SWQC members at other forums. Thus, these minutes also serve as a record of the referenced documents and make this document lengthy. The hearing minutes *per se* are two pages.

1. The meeting came to order at 7:30 PM. There was no public comment.
2. Minutes of the previous meeting were approved 3-0.
3. Dudley Pond

    a. Divers were out surveying and pulling milfoil. Some plants observed, but not a heavy population. Allison reported 21 plants observed and pulled. Ted reported a small number of old plants that were pulled. Reports appended as maps in Attachment 1..

    b. As required by our Order of Conditions 322-798, this spring we took two raw water samples from each of the Happy Hollow wells. The samples were separately analyzed for residues of Triclopyr (used in 2010) and Fluridone (used in 2008). No detectable concentration of either herbicide was detected. Test results are included in Attachment 2..

    c. The first water sampling program for phosphorus and α-chlorophyll has been conducted as part of determining the ponds eutropic state. Toni's report is appended in Attachment 3. Two more sampling cycles (summer and fall) will be conducted.

    d. The proposal to DEP to determine the TMDL of nutrients in the pond was not funded (rejection letter in Attachment 4).

    e. A discussion was held about possible strategies for approaching Town Boards about potential bylaws/enforcement to better regulate septic system discharges and stormwater runoff. SWQC will collect relevant regulations from other Towns, e.g. Nantucket, that address means to reduce nutrient inflows into ponds and lakes. A study of septic systems on the east side of the pond has been conducted and presented to the BOH. Toni performed the data collection and prepared a first draft. Toni and Mike analyzed the data. The draft report and BOH presentation are in Attachment 5.

    f. The progress of the Dudley Area Advisory Committee was reviewed by Mike and Bob, and the selection of the contractor to perform the study contract was confirmed.

    g. OARS is holding a water column sampling training program on the 12th. Mike, Tom and Lin will attend.

    h. A discussion was held about possible public access points that could be created by the Town, at Mansion Beach, Town land near the Chateau, and Rocky Point. The Committee will develop conceptual plans over the next few months for presentation to various Town Boards, and would recommend use of CPA funds for this.

4. North Pond.

    a. The milfoil capture net (with groins) has been installed at the North Pond side the Route 30 bridge. Lin has been removing captured milfoil fragments regularly. The flow of fragments into North Pond from Middle Pond seems fairly heavy. A report of the milfoil collected by Lin is in Attachment 6. This fragment collection and measurements of amount collected will continue through the summer

    b. A weed survey conducted by SWQC has shown moderate levels of milfoil in North Pond, in the usual locations. A map of last year's milfoil population is in attachment 7.

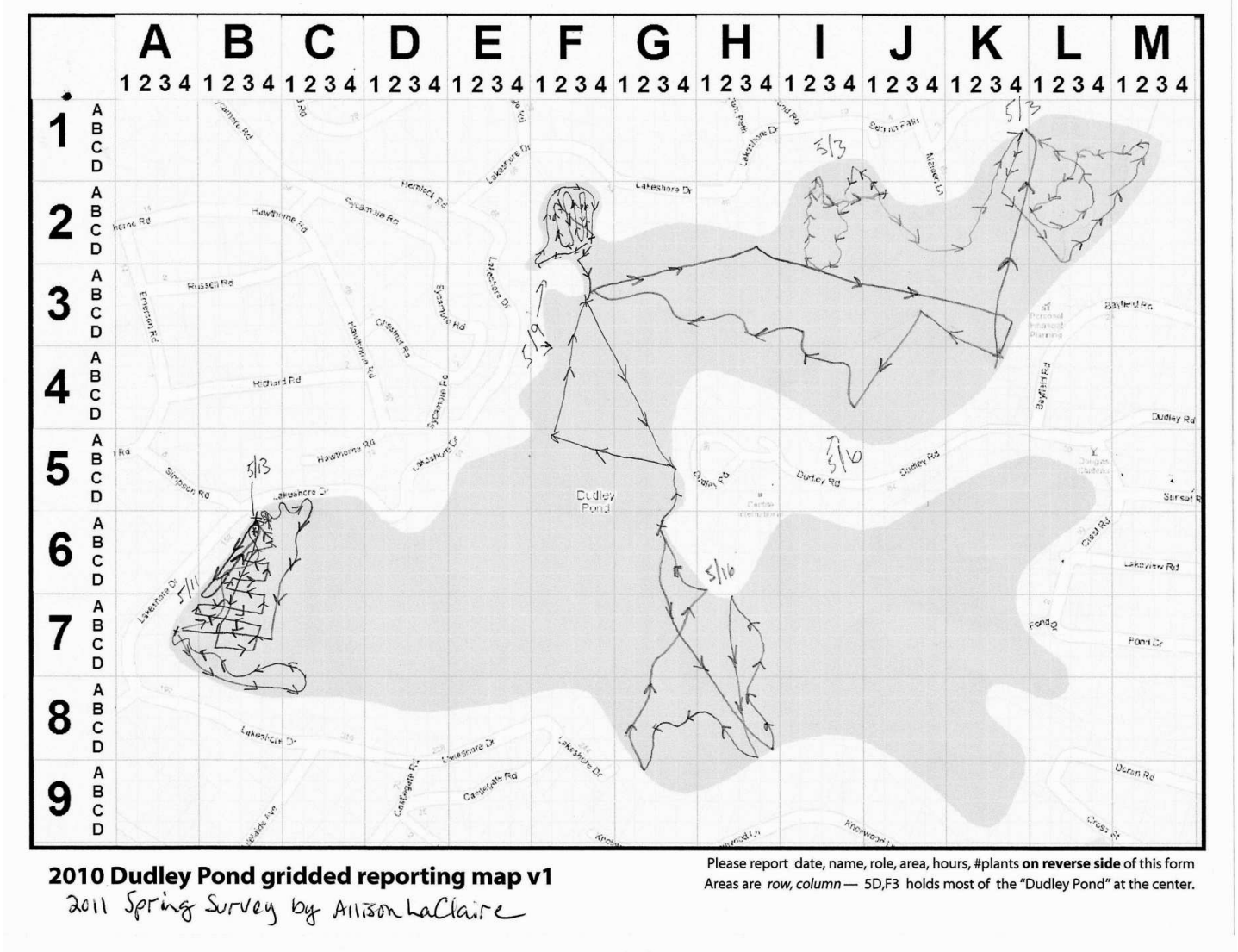
    c. The DCR Commissioner is coming to Lake Cochituate on June 8th. Lin Bradford will represent SWQC in the planning of this visit

    d. An end of season report for 2010 been prepared by Toni, reviewed by Mike, and submitted to ConCom. This was based on DCR's 201o report for the pond.

5. Heard Pond. Lycott's proposal for water chestnut harvesting for this year came in under $5,000, and a contract has been let.

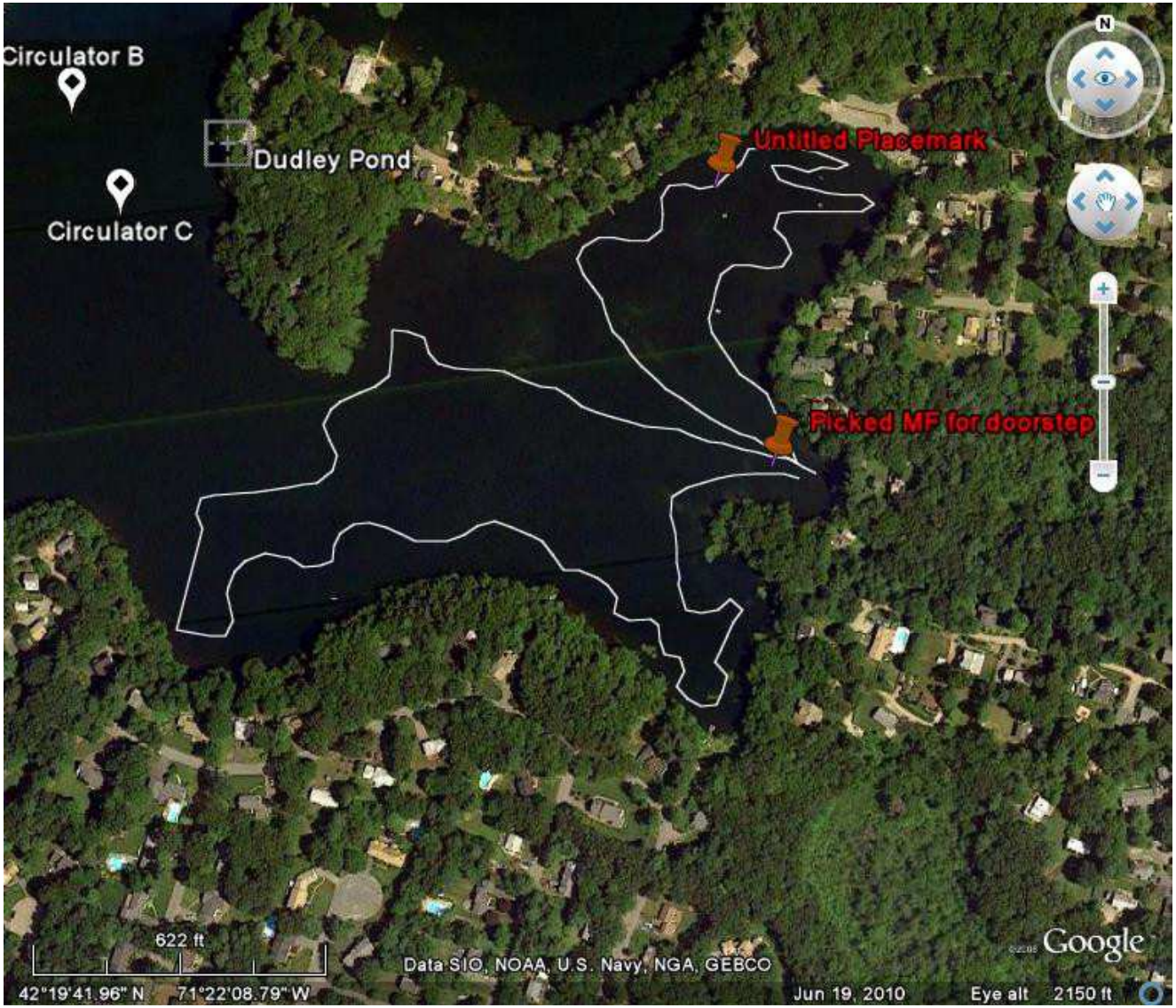
6. The committee voted 4-0 to adjourn at about 8:30 PM.

Attachment 1
Diver Surveys of Dudley Pond for Milfoil – Early May, 2011



2010 Dudley Pond gridded reporting map v1
2011 Spring Survey by Allison LaClaire

Please report date, name, role, area, hours, #plants **on reverse side** of this form
Areas are *row, column* — 5D,F3 holds most of the "Dudley Pond" at the center.



Milfoil Survey in Dudley Pond by Ted Fiust (May 8, 2011)

Attachment 2
SEPRO Analyses of Happy Hollow Well Water for Herbicide Pressence

SRTC SePRO Research & Technology Campus SePRO

Chain of Custody CE0BC983-1

Customer Company		Customer Contact	
Company Name:	Aquatic Control Technology, Inc.	Contact Person:	Gerald N
Address:	11 John Road	E-mail Address:	gnsmith@aquaticcontroltech.com
City:	Sutton	Phone:	
State:	MA 01590-2509	Fax:	

Payment Information

Payment Type:	Invoice	Card Number/Expiration Num:	

Waterbody Information

Waterbody:	Dudley Pond	Waterbody Size (acres):	86.00
Depth Average:	8.00		
Target Plants	Eurasian Watermilfoil,		

Sample Information

Sample Site ID	Date Treated	Date Sample Collected	Sample Location	Products	Acres Treated	Rate	Active	Result
HH1	05/02/2010	05/03/2011		Renovate OTF	18.5	4036	Triclopyr	0.000 ppm
HH2	05/02/2010	05/03/2011		Renovate OTF	18.5	4036	Triclopyr	0.000 ppm

Laboratory Information

Date Received:	5/6/2011	Date Analysis Performed:	5/6/2011
Date Results Sent:	5/6/2011	Storage Conditions	Analyzed Immediately

SRTC SePRO Research & Technology Campus

Chain of Custody ADFD30CD-5

Customer Company		Customer Contact	
Company Name:	Aquatic Control Technology, Inc.	Contact Person:	Gerald N
Address:	11 John Road	E-mail Address:	gnsmith@aquaticcontroltech.com
City:	Sutton	Phone:	
State:	MA 01590-2509	Fax:	

Payment Information

Payment Type:	Invoice	Card Number/Expiration Num:	

Waterbody Information

Waterbody:	Dudley Pond	Waterbody Size (acres):	86.00
Depth Average:	8.00		
Target Plants	Eurasian Watermilfoil,		

Sample Information

Sample Site ID	Date Treated	Date Sample Collected	Sample Location	Products	Acres Treated	Rate	Active	Result
HH1	07/31/2008	05/03/2011		Sonar A.S., Sonar PR, Sonar Q	86	12	Fluridone	**<1.0 ppb**
HH2	07/31/2008	05/03/2011		Sonar A.S., Sonar PR, Sonar Q	86	12	Fluridone	**<1.0 ppb**

Laboratory Information

Date Received:	5/4/2011	Date Analysis Performed:	5/4/2011
Date Results Sent:	5/4/2011	Storage Conditions	Analyzed Immediately

Attachment 3
First 2011 Dudley Pond Water Column Sample Analysis
and Initial Analysis of State of Eutrophication

Dudley Pond Water Quality Sampling Program

April 4, 2011 – Toni Moores

This document is the first report of an ongoing Surface Water Quality Committee (SWQC) water quality sampling program initiated for Dudley Pond. The objectives of the Program are to gather Dudley Pond water quality data that will be used to:

- Compare to similar water quality data gathered in the past.
- Track the trophic index of Dudley Pond during the spring, summer and fall of each year.

Summary

- On April 4, 2011 water quality data was gathered at three sample points and at three depths at each sample point.
- Water quality parameters such, pH, oxidation – reduction potential (ORP), dissolved oxygen, dissolved oxygen % saturation and temperature were measured at three depths at each of the three sample points by SWQC members using a YSI Multimeter. Water and Secchi depths were measured at each of the three sample points.
- Samples were analyzed by Nashoba Analytical LLC and SWQC also analyzed samples for Total Phosphorus (TP).
- SWQC's spectrophotometer (Orion AQ 4000, protocol AC4P95) was found not to be usable to measure TP at concentrations below 50 ppb. An attempt will be made to analyze samples taken during August using the AQ 4000 instrument.
- The water quality in Dudley Pond was found to be remarkably good at the points sampled, based primarily on the Carlson Trophic State Index (TSI), which is a function of Secchi depth, Chlorophyll a and TP concentration. The average TSI range for the three sample points was found to be 32 – 49 (high oligotrophic – high mesotrophic), but if the past holds true for 2011, the TSI for the August 2011 sampling is expected to be 47 – 58, which is high mesotrophic – low eutrophic.

Background

Historically Dudley Pond has been sampled most frequently at the "deep hole" (Sample Point 25) on Dudley Pond. In order to have data sets that are comparable to historical data, samples are to be gathered at locations 24, 25 and 27 as indicated in Figure 1. Two of these sample locations correspond to the sample locations used in the Larkin and IEP studies. Line-of-site intersections are to be used to locate sampling points.

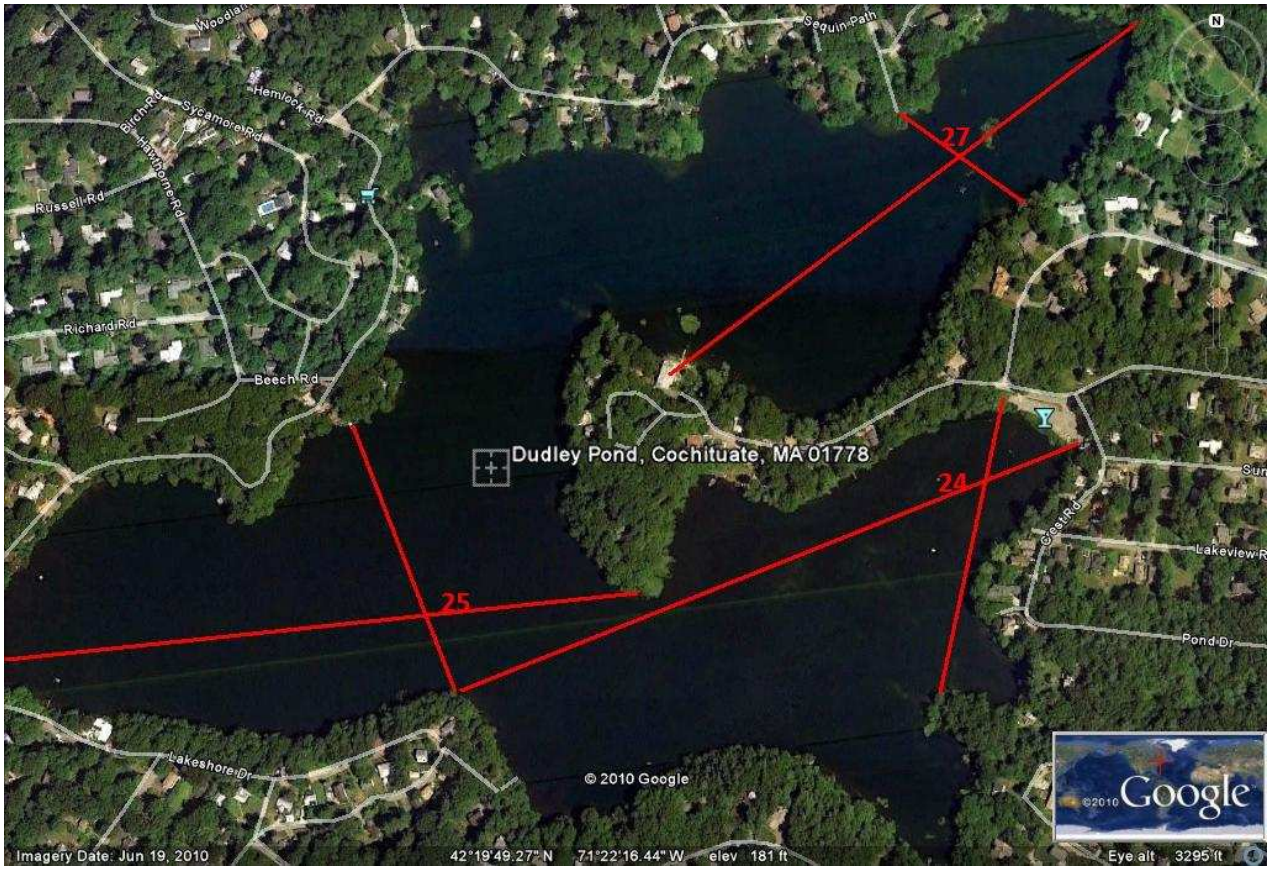


Figure 1 – Dudley Pond Sampling Points

Sample Point 24 is located at the intersection of the lines-of-site between Rocky Point – Bayfield Rd and Mansion Beach – "The Chat". Sample Point 25 is located at the intersection of the lines-of-site between Mansion Beach –Southern point of the Dudley Rd. peninsula and Lowery's dock – Williams Point. Sample Point 27 is located at the intersection of the lines-of-site between the Dudley Pond outlet – 107 Dudley Rd. and the foot of Maiden Lane – the 20" outfall adjacent 27 Bayfield Rd.

Methods

Samples will be gathered at depths of one foot, at mid depth and one foot off the bottom at Sample Points 24, 25 and 27. A water sampler as shown at http://www.aquaticeco.com/subcategories/2912/Water-Sampler?green=12823266105 with a sample volume of 1.0 – 1.5 liters was used to gather samples at various depths. Data and samples are to be gathered during March, August and November each year.

Sample Handling - Multiple samples at each depth were composited from the sampler into a one gallon container in order to get the volume of sample needed for the various analyses. The one gallon container was mixed and aliquots were poured into sample bottles provided by the analytical laboratory. The labels on the sample containers were filled out. One of the sample bottles contained sulfuric acid necessary to "fix"(preserve) the sample for total phosphorus (TP) analysis. Approximately 50 ml of the "fixed" sample was poured into a pre-rinsed container to be analyzed for TP by SWQC. All of the samples were stored in a cooler containing ice and delivered with chain of custody documents to the analytical laboratory the day after the samples were gathered.

Sample Analyses – A SWQC owned YSI 556 Multimeter was used to measure the following parameters at the same time that the samples are collected.

Date

Time

Weather

Barometric Pressure

Location

Depth

pH

ORP

Dissolved Oxygen

Dissolved Oxygen % Saturation

Temperature

Secchi Depth

Nashoba Analytical, LLC was used to perform analyses of samples from Sample Points 24, 25 and 27. Analyses were performed by Nashoba Analytical, LLC for the following parameters.

Total Phosphorus (as P) (Soluble and Insoluble)

Orthophosphate (as P) (Soluble)

Ammonia (as N)

Nitrate/Nitrite (as N)

Total Nitrogen (as N)

Chlorophyll *a*

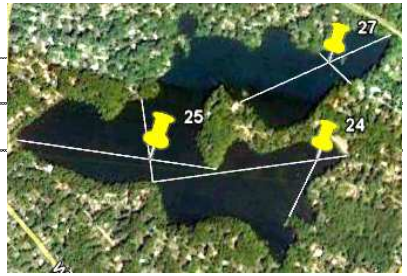
SWQC also analyzed samples for total phosphorus using an Orion AQ 4000 according to protocol AC4P95 to see if the AQ 4000 could be used to obtain reliable total phosphorus analyses that were similar to the results obtained by Nashoba Analytical.

Carlson Trophic State Index – TP concentrations, Chlorophyll a and Secchi depths were used to plot the Carlson Trophic State Index (TSI) for the three sample points in Dudley Pond. Since the Secchi Depths for Sample Points 24 and 27 were greater than the depth of the water, it was assumed that the Secchi Depths for all of the sample points were the same as Sample Point 25 equaling 12' 1" or 3.6 m. In order to obtain an average TP concentration for each sample point the three Total Phosphorus concentrations for the sample point were averaged. In order to obtain an average Chlorophyll a for each sample point, the average of the chlorophyll a concentration was calculated for each depth at each sample point. (see http://www.aslo.org/lo/toc/vol_22/issue_2/0361.pdf for information re Carlson Trophic State index)

Results

The results of the April 4, 2011 sampling are shown in Figure 2, attached. The TP analyses done by SWQC with the AQ 4000 are shown in red on Figure 2. The analytical data was plotted to determine the TSI and is shown in Figure 3.

Date / Time:	April 04,2011 Start 13:00
Samplers:	Moores, Lowery
Weather:	Sunny, Gusty Winds, 50 F
Barometric Pressure:	761.1 mm



	SP 24-top	SP24-mid	SP24-bot	SP 25-top	SP25-mid	SP25-bot	SP27-top	SP27-mid	SP27-bot
Depth (ft)	1	3	6' 3"	1	12	24	1	3' 2"	6' 4"
pH	7.22	7.24	7.21	7.14	7.1	7.07	7.15	7.13	7.14
ORP (mv)	253.4	248.6	251.4	257.3	250.3	251	120.4	119.8	120.6
DO (ppm)	13.05	12.85	12.8	12.66	12.12	12.07	12.92	12.93	12.93
DO%	108.9	106.8	106.4	103.2	98.3	97.9	106.7	106.6	106.9
Temp C	7.36	7.32	7.32	6.45	6.38	6.32	7.1	7.08	7.02
Secchi Depth	6' 3"			12' 1"			6' 4"		
Total Phosphorus (as P)	0/10	477/40	0/20	74/ND	162/ND	25/10	52/ND	112/10	0/10
OrthoPhosphate (as P)	ND	ND	ND	ND	ND	ND	ND	10	ND
Ammonia (as N)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrate/Nitrite (as N)	320/ND	320/ND	340/ND	290/ND	280/ND	290/ND	330/ND	310/ND	330/ND
Total Nitrogen (as N)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorophyll a	2.95	2.74	3.99	3.87	3.81	3.72	2.72	3.69	3.17

All units above are ppb

Red numbers are based on SWQC results from analyses using an Orion AQ 4000 and AQUAfast IV protocol AC4P95.

Figure 2 – Dudley Pond Water Quality Data Results

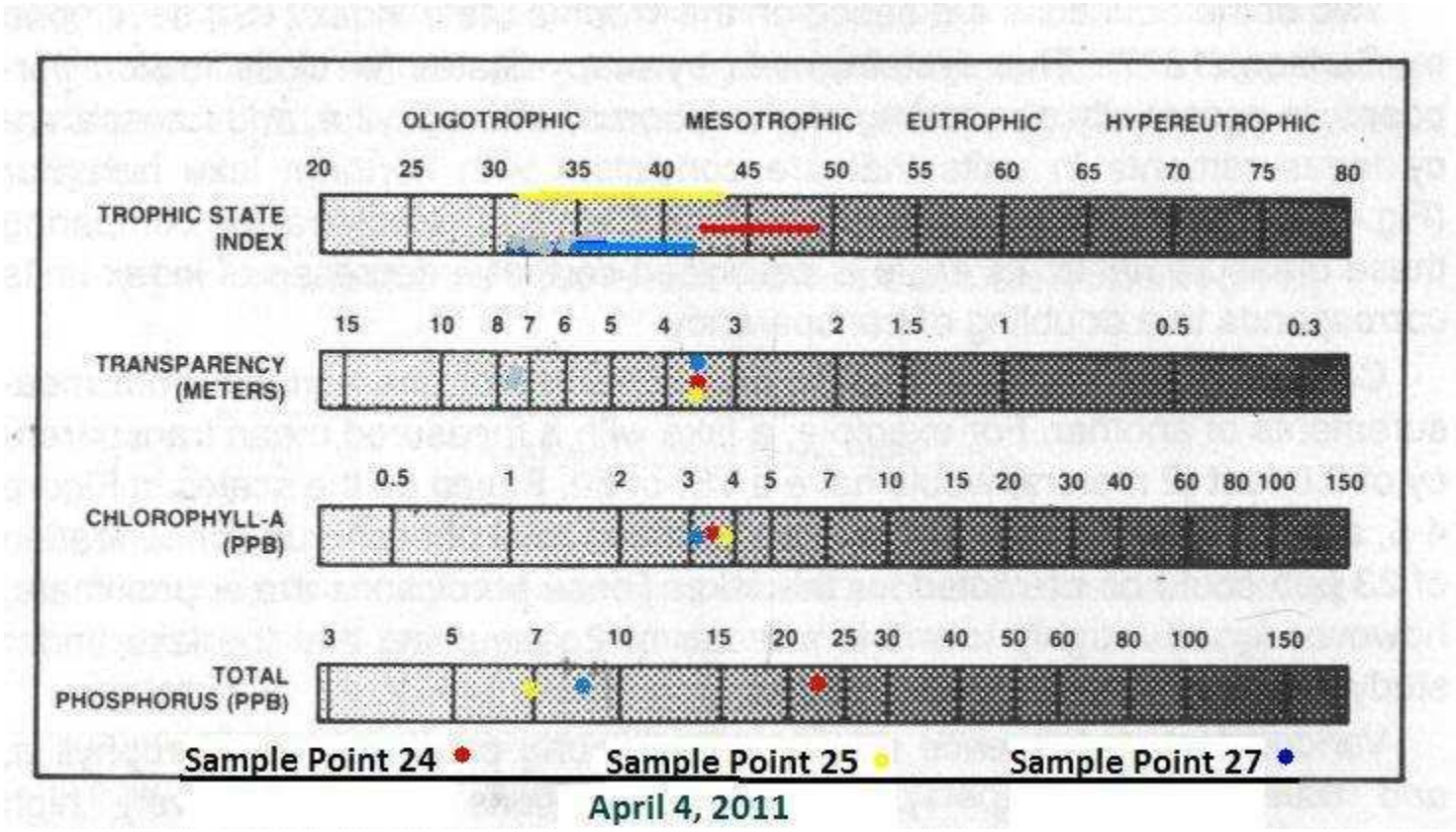


Figure 3 – Carlson Trophic State Index Results, Sample Points 24, 25 & 27

Discussion

YSI Measurements - Measurements taken with the YSI 556 Multimeter were relatively similar for all parameters from top to bottom and sample point to sample point, with the exception of the ORP reading at Sample Point 27. The ORP at sample point 27 was approximately half of the ORP value at sample points 24 and 25. The reason for this variation is not known. Of note is the dissolved oxygen percent concentration, which was supersaturated at all sample points and depths. This indicates that there is little biodegradation at the bottom possibly due to the low temperature and sunlight was penetrating most of the water column resulting in photosynthesis, due to benthic algae as well as limited suspended algae. The lack of stratification of the Pond is possibly due to the fact that April 4th may have been close to the Pond's spring rollover (thermal mixing).

Secchi Depths – Secchi depths (a measure of turbidity) were very large (> 12 feet) at all sample points compared to Secchi depth taken during the summer months, which have been a low as 1.5 feet. Large Secchi depths indicate that there is very little color and suspended materials such as algae and soil solids in the water column. Accurate Secchi depths at Sample Points 24 and 27 could not be obtained because the bottom was clearly visible implying the Secchi depth was greater than the bottom depth. It has been assumed that the Secchi depths at Sample Points 24 and 27 were similar to that at Sample Point 25, which was 12' 1'.

SWQC Total Phosphorus Analysis – As can be seen from Figure 1 the TP analyses (red font) obtained using the AQ 4000 and protocol AC4P95 were erratic, at best. Orion technical service was contacted to sort out the problem. Despite the fact that the protocol AC4P95 data sheet claims an applicable concentration range of 0.0 – 2.5 mg/l, the Orion tech service representative stated that protocol AC4P95 has a minimum measurable concentration of 50 ppb. As a result it was determined that the AQ 4000 could not be used to reliably measure the TP concentration in samples that contain less than 50 ppb, such as the samples gathered in Dudley Pond on April 4, 2011. An attempt to measure TP concentrations in Dudley Pond water samples using the AQ 4000 (AC4P95) will be attempted during the summer sampling when the total phosphorus concentration is expected to be higher.

Carlson Trophic State Index – As Dudley Pond is primarily used for recreational purposes a TSI less than 50 is tolerable and less than 40 would be great. The TSI for the three sample points ranged from 31 to 49. A TSI of 31 indicates a mid-oligotrophic state and a TSI of 49 indicates a high mesotrophic state. The average TSI range for all three sample points was 36 to 45, which indicates that on April 4, 2011, Dudley Pond had a TSI in the low to mid mesotrophic range. Lacking significant inorganic suspended solids or soluble color bodies in the water column, Secchi depth and Chlorophyll a are essentially measurements of suspended biomass (algae) and neglecting TP concentrations, all data sets result in remarkably close agreement indicating a TSI range of 42 – 44, which is low mesotrophic. The fact that the Secchi Depths and Chlorophyll a are in the 42 – 44 range for all of the sample points, may be an indication that sunlight and/or temperature at the sampling date are the growth limiting factors for algae rather than phosphorus. As the growth season progresses and temperature and sunlight in the water column increase stimulating biological decomposition/release of phosphorus compounds from bottom sludge and surface water runoff contributing more phosphorus, phosphorus concentrations will increase and

will then become the growth rate limiting factor resulting in significant increases in algae biomass concentrations (higher chlorophyll a concentrations and smaller Secchi Depths). For perspective purposes (see attachment) Dudley Pond Secchi Depth data has historically resulted in a TSI of 45 – 53 (high mesotrophic) and TP concentrations have resulted in a TSI range in the 37 – 65, low mesotrophic – low hypereutrophic. It would appear from historical Dudley Pond data, in order to compare TSI values the time of the year that the samples are gathered seems to be important with June, July and August being the worst with regard to TSI values and spring/fall being the best.

Attachment

Summary Historical Dudley Pond Trophic State Data

Secchi Disc Data

- 2007 WSWQC Avg. for summer 1.93 m
- 2007 WSWQC Avg. for 11/18/07 sampling 2.8 – 2.9m
- IEP Data for sample point 25
  3/26/81 – 9.2' or 2.8 m = 45 TSI

  6/26/81 – 9.9' or 3 m = 44 TSI

  7/31/81 – 5.6' or 1.7 m = 53 TSI

  8/24/81 – 7' or 2.1 m = 49 TSI

  3/10/82 – 8.5' or 2.6 m = 47 TSI

- 1978 Larkin got an avg. Secchi of 1.93 m
- Using a Secchi range of 1.7 – 3 m results in a Trophic State Index (TSI) of 44 – 53, which is high range mesotrophic

Total P Data

- Larkin 6/6/78 – 43 ppb
- IEP Data for sample point 25 Avg. TP results in TSI range 44 – 58

Date	Surface ppb	Mid ppb	Bottom ppb	Avg ppb	TSI
3/26/81	10	-	20	15	44
6/26/81	30	20	70	40	58
7/31/81	<10	<10	50	17	45
8/24/81	20	30	40	30	53
3/10/82	20	10	30	20	47

- ESS 6/9/05 – 20 ppb
- Geosyntec 2007 stormwater runoff total P range from six sources over five significant rain events was 20 – 508 ppb. Note these are concentrations of rainwater entering the Pond, not total P concentrations in the Pond.
- G&L Labs 11/28/07 – 29 ppb & 10/14/07 – 32 ppb
- WSWQC 11/18/07 Avg - 21.2 ppb, 10/14/07 Avg -126 ppb, 7/21/07 Avg – 180 ppb
- Discarding the WSWQC data taken on 10/14/07 & 7/21/07, we get a total P range of 10 – 70 ppb, which corresponds to a TSI range of 37 – 65, which is low mesotrophic – low hypereutrophic.

Chlorophyll A Data

- IEP Data for sample point 25
  3/26/81 – 5.54 ppb = 47 TSI

  6/26/81 – 1.7 = 34 TSI

  7/31/81 – 6.8 = 48 TSI

  8/24/81 – 7.0 = 50 TSI high mesotrophic

Summary

Based on the limited data available, one would have to conclude that Dudley Pond has been on the margin between mesotrophic and eutrophic at least since 1978 (Larkin), depending on the sampling date,

Attachment 4
DEP Rejection Letter for SWQC Proposal

MassDEP
Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
One Winter Street Boston, MA 02108 • 617-292-5500

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

May 5, 2011

Fredric Turkington, Town Administrator
Town of Wayland
41 Cochituate Road
Wayland, MA 01778-2614

Dear Mr. Turkington:

Thank you for submitting a proposal for the 604 (b) Water Quality Management Planning Projects for Federal Fiscal Year 2011. The Department received and reviewed 11 proposals, and has awarded four grants. I regret to inform you that your proposal, *Dudley Pond Water Quality Assessment and TMDL Development*, was not recommended for funding. Eligible proposals were ranked using the evaluation criteria listed in the RFR and funds were awarded according to rank.

Program staff members are available to discuss the pluses and minuses of your proposal. I hope that you will consider applying for Water Quality Management Planning funding in the future and that you will contact the Department to discuss any ideas that you might have for assessment and planning projects.

Sincerely,

Steven J. McCurdy, Director
Division of Municipal Services

Cc: Mr. Toni Moores, Wayland Surface Water Committee

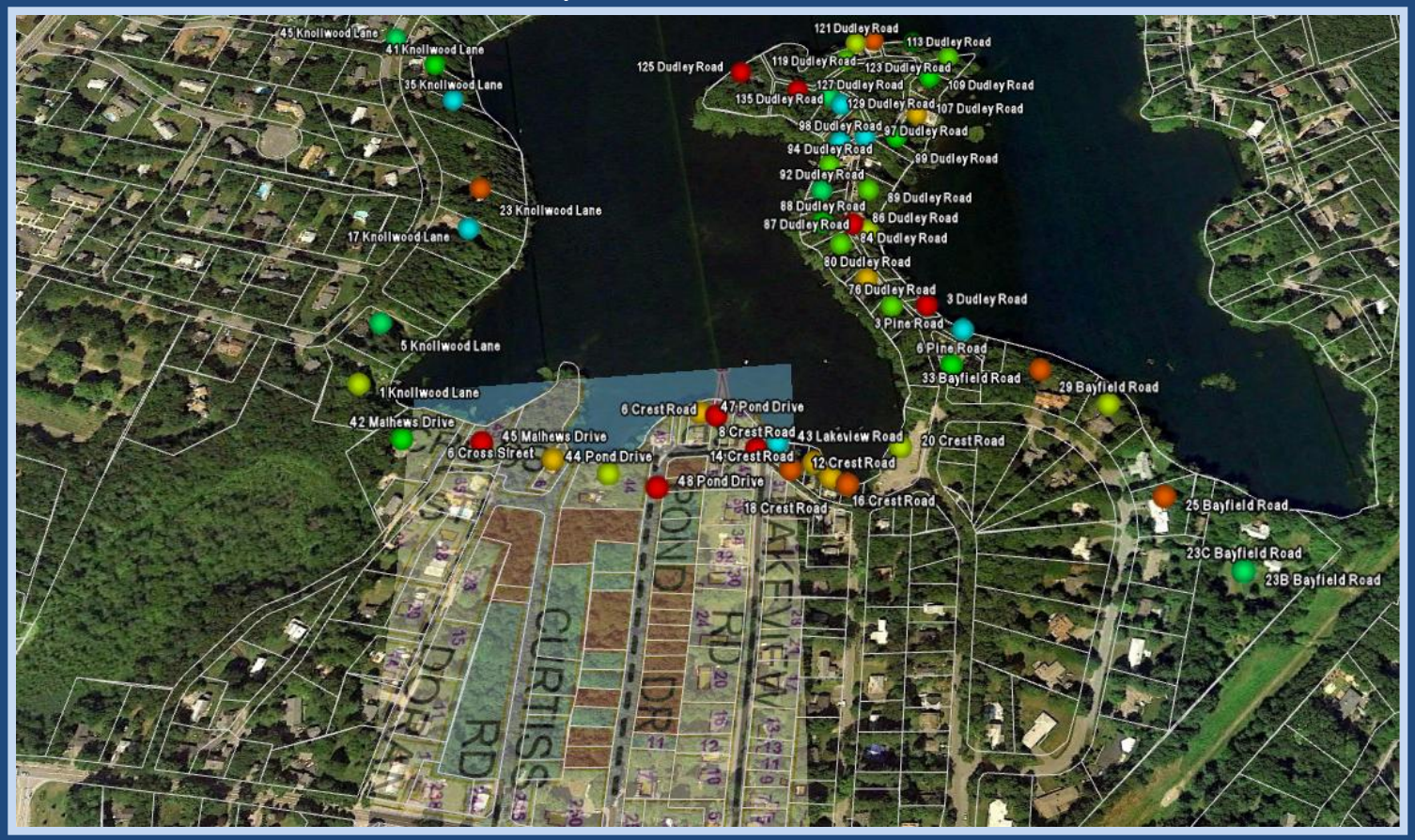
Attachment 5
Draft Report for East Side of Dudley Pond Septic Systems and
BOH Presentation

East Dudley Septic Study

Presentation by Toni Moores & Mike Lowery, WSWQC to the

Board of Health

April 26, 2011



What is the Surface Water Quality Committee?

Selectmen-appointed, volunteer, modest budget, limited authority

Mission: Health of Wayland's Surface Waters:

Sudbury River
Heard Pond
North Pond of Lake Cochituate
Dudley Pond

What does WSWQC Do ?

- Assessment & Monitoring
- Invasive Weed Control
- Control and Reduce Nutrients from:
  Septic Systems, Surface Water Runoff
- Education & Coordination:
  Health, Conservation, Public Works, Selectmen, Community Preservation, Recreation, Schools Lake associations & Interest Groups, State Reps, the DCR.

E. Dudley Septic Study - Purposes

- Gather data for a TMDL
  'Total Maximum Daily Load'
  a phosphorus budget for Dudley Pond
- Assess available septic information 'quality'
- Inform land use decisions, improve septic regulations, prioritize enforcement and remediation.
- Consolidate data for other consultants

E. Dudley Area Septic Study - Content

- Assesses relative phosphorus contribution of septic systems to Dudley Pond health
- Creates a prioritization model by septic characteristics
- Database of 50 parcels in the most sensitive areas – more parcels to be analyzed in the future.
- Identifies missing or limited data

What's Dudley Pond like? - Demographics

- Dense—Small lots
- Septic systems close to water
- Permanent residences began in the 30s

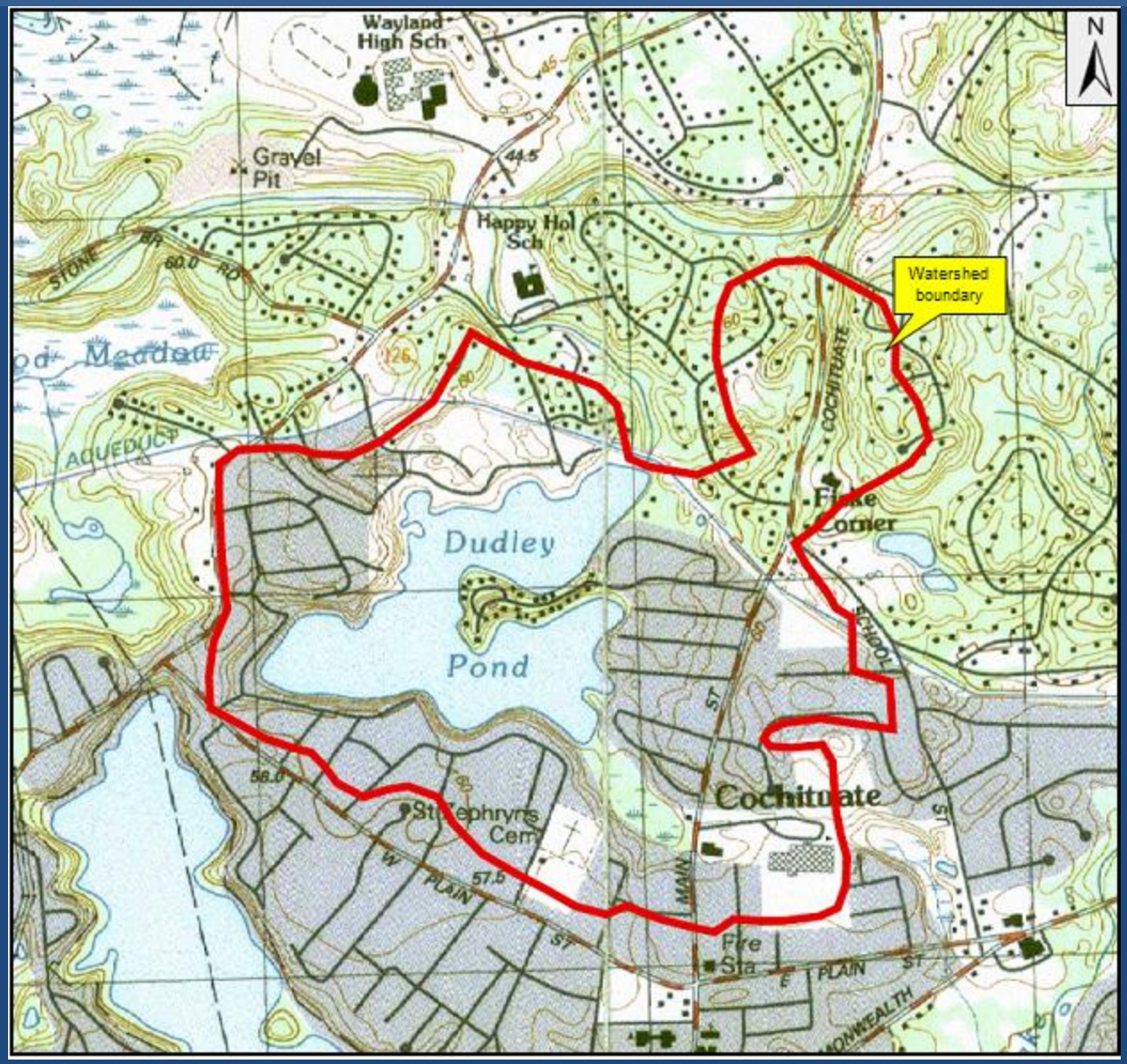
  Many older septic systems

Dudley Area Parcels

What's Dudley Pond Like? - Watershed

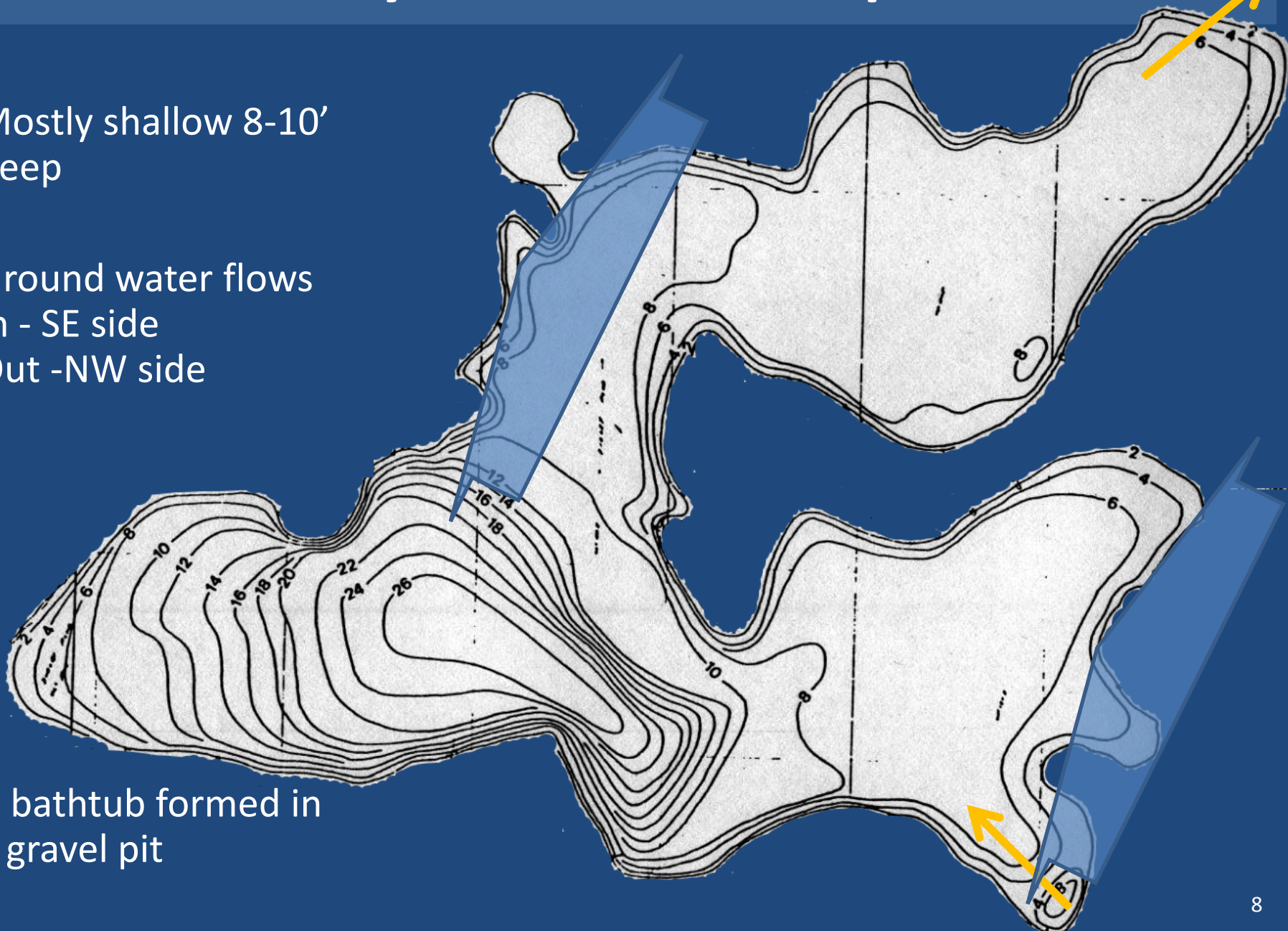
Small surface watershed.

Groundwater flow is more significant than surface water flow

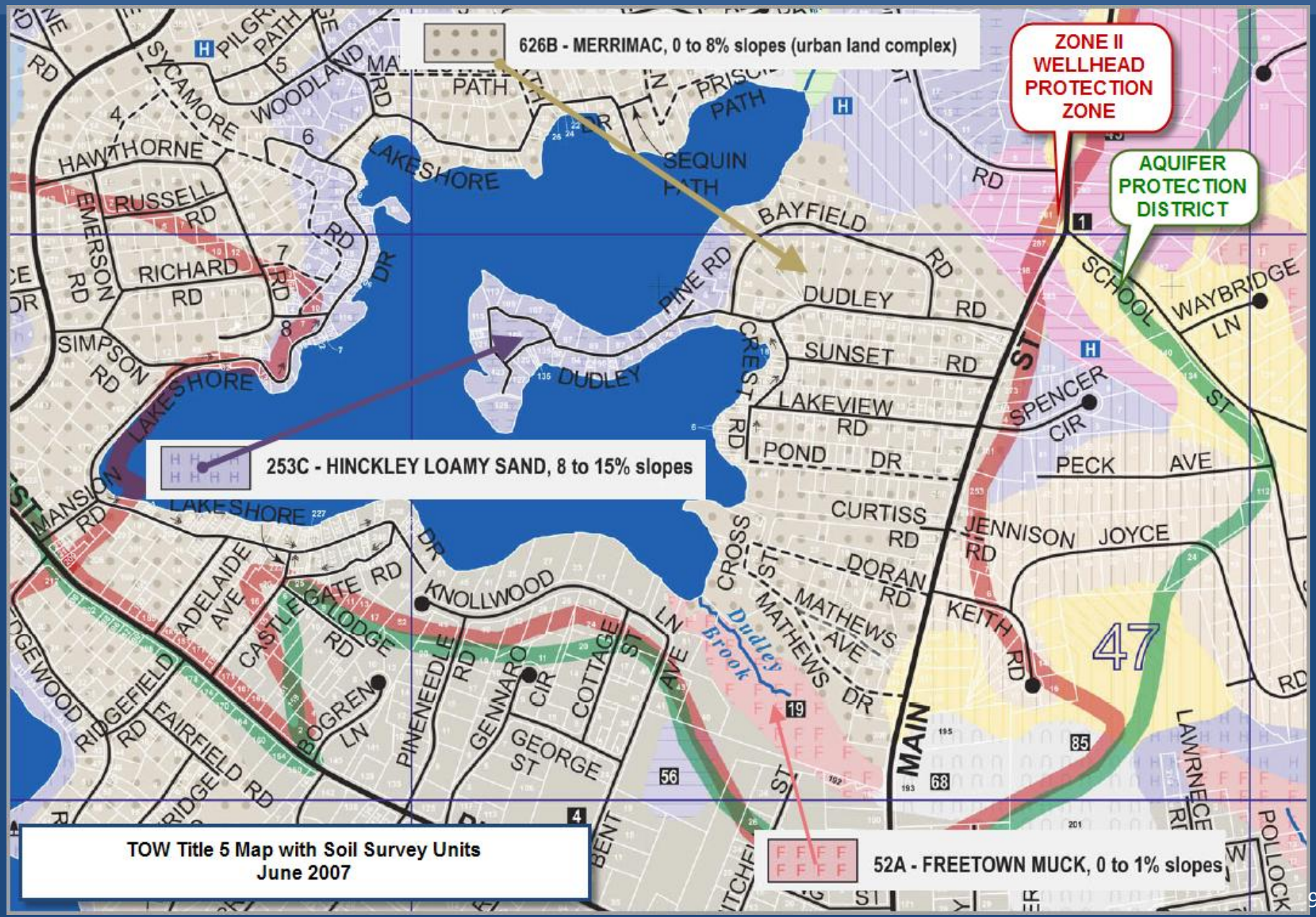


What's Dudley Pond like? – Depth & Flows

- Mostly shallow 8-10’ deep
- Ground water flows
  In - SE side
  Out -NW side
- A bathtub formed in a gravel pit



What's Dudley Pond like? – Soils



"Merrimac Urban Complex 626B"

MnB-Merrimac-Urban land complex, 0 to 8 percent slopes. This map unit consists of nearly level and undulating Merrimac soil and similar soils and areas of Urban land on broad plains. The Merrimac soil is very deep and somewhat excessively drained,

Soil properties of the Merrimac soil:

- *Permeability:* Moderate or moderately rapid in the surface layer and the subsoil and rapid or very rapid in the substratum.
- *Available water capacity:* Moderate.
- *Soil reaction:* Very strongly acid to moderately acid throughout.
- *Depth to bedrock:* More than 60 inches.
- *Depth to the seasonal high water table:* More than 6 feet.
  Hydrologic group: A.

The Merrimac soil has no major limitations for building site development or for local roads and streets. If the soil is used as sites for septic tank absorption fields, ground water pollution is a hazard. Because of rapid or very rapid permeability, the soil readily absorbs but does not adequately filter the effluent.

"*Soil Survey of Norfolk and Suffolk Counties, Massachusetts (Peragallo, 1989)*"

What's Dudley Pond like? – Water Quality

U.S. ENVI

Watershed Assessment, Tracking & Environmental ResultS

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You are here: EPA Home » Water » WATERS » Water Quality Assessment and TMDL Information » Waterbody Quality Assessment Report

Return to home page

On This Page

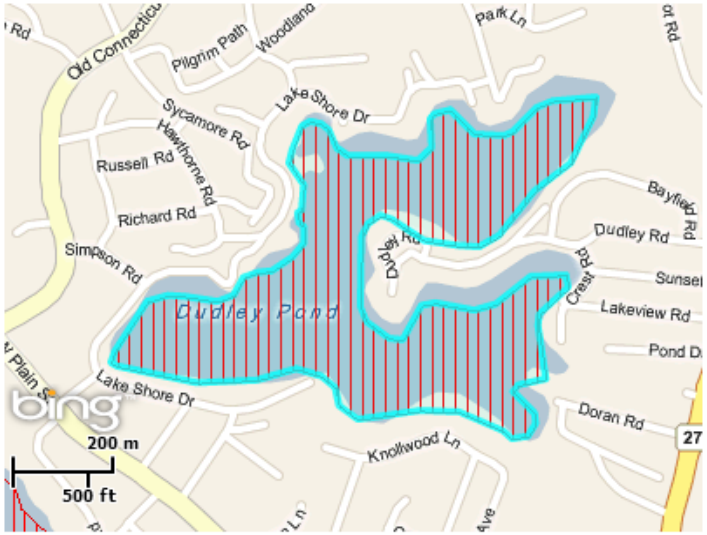
- Causes of Impairment
- TMDLs That Apply to This Waterbody
- Previous Causes of Impairment Now Attaining All Uses

State: Massachusetts
Waterbody ID:
Other ID: MA82029
State List ID: MA82029
Location: Wayland; 82029
State Waterbody Type: Lake/Reservoir/Pond
EPA Waterbody Type: Lakes, Reservoirs, and Ponds
Water Size: 84
Units: acres
Watershed Name: Concord

Waterbody History Report

Data are also available for these years: 2004 2002 1998 1996

2006 Waterbody Report for Dudley Pond



Click on the waterbody for an interactive map

2008 Same Status on MA DEP 303d list to US EPA

CATEGORY 5 - most impaired, requring a TMDL

Causes of Impairment for Reporting Year 2006

Description of this table

Cause of Impairment	Cause of Impairment Group	State TMDL Development Status
Organic Enrichment/Low Dissolved Oxygen	Organic Enrichment/Oxygen Depletion	TMDL needed
Turbidity	Turbidity	TMDL needed

What's Dudley Pond like? – Eurasian Milfoil

Dudley looks great today – What's the problem?

Its a money pit -- Annual invasive weed control– diver hand pulling and herbicide costs $20,000-$80,000 annually (DPA pays 25%)

It's Close to Eutrophication:

Invasive weeds and algae LOVE the nutrient rich waters of Dudley Pond

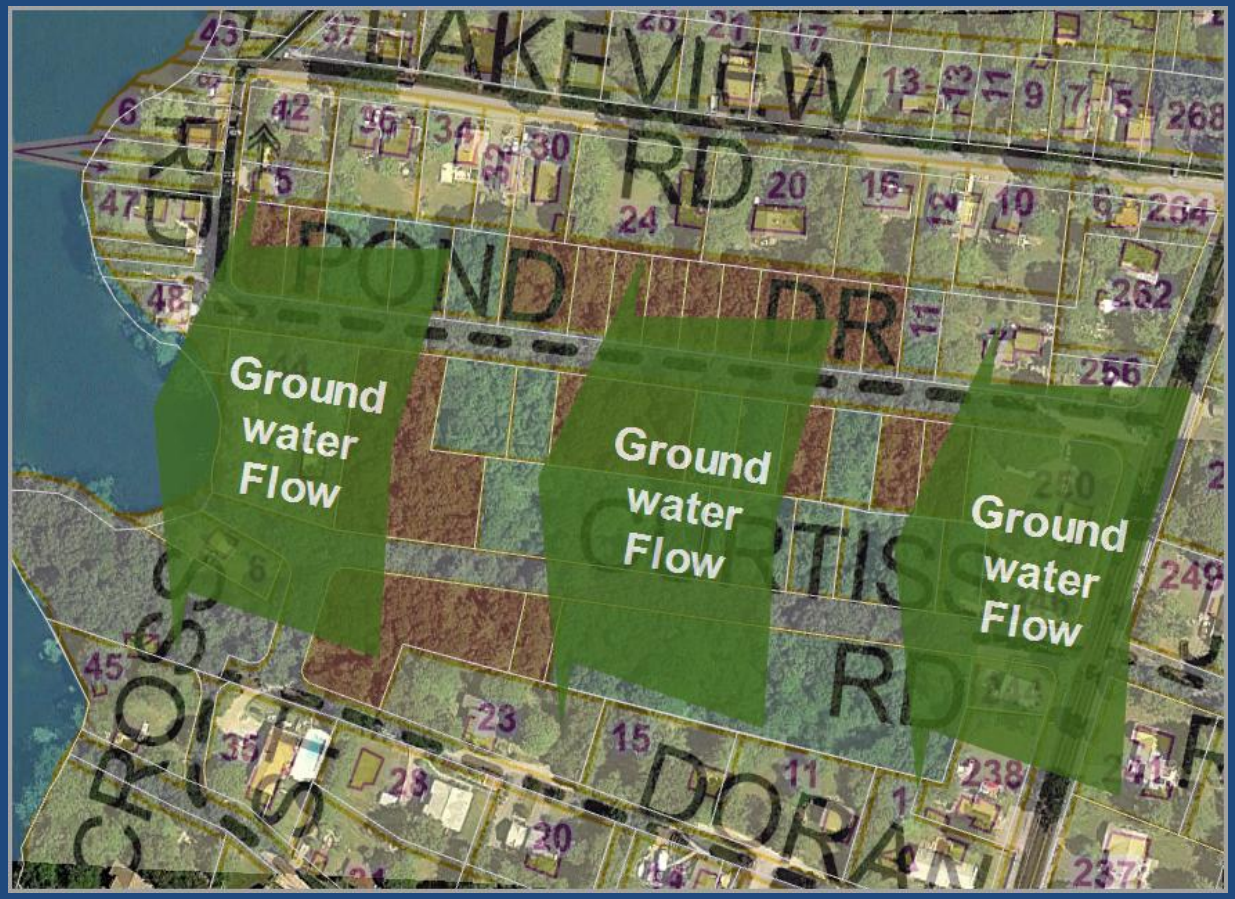
Wayland, the state, and DPA have been treating with herbicides since 1970 (Larkin Report)

Why does Dudley Pond Have Milfoil?

Phosphorus and Nitrogen from surface water runoff (fertilizer) and groundwater (septic)

Why are the Dudley Area parcels important?

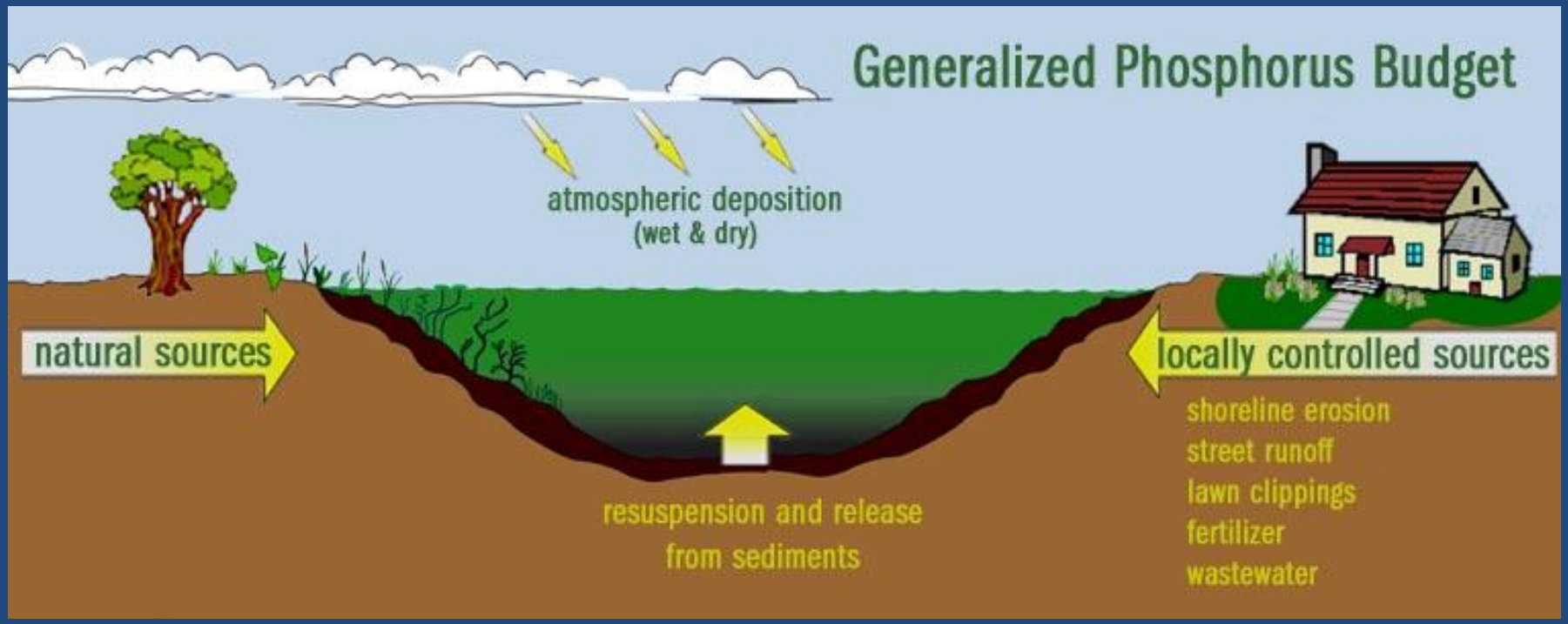
- Ground water flows toward the pond
- Sandy soils - may conduct Phosphorus to the pond
- An increase of use could add nutrients



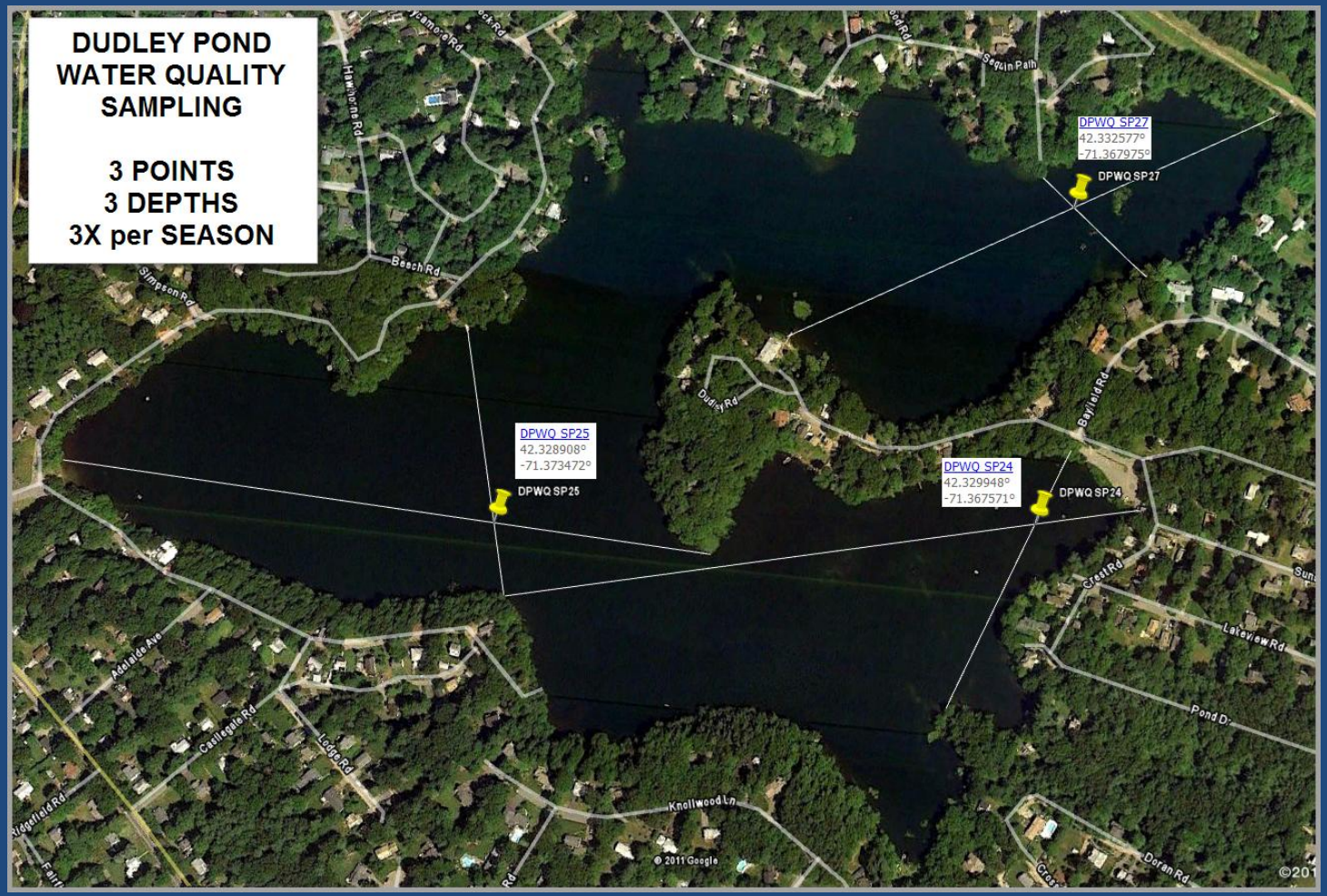
1983 Diagnostic/Feasibility Study of Dudley Pond
I.E.P. Chapter 2, p 10.

What are the Sources of N & P?

- Surface water runoff
  Improved mid-80's with EPA-funded paving and drainage improvements.
- Septic leachate
- Sediment mixing



2011 Water Quality Sampling



COLLECTED:

Date, Time
Weather
Barometric Pressure
Location
Depth
pH
ORP
Dissolved Oxygen
Dissolved Oxygen % Saturation
Temperature
Secchi Depth

ANALYSIS: Total Phosphorus (as P), Orthophosphate (as P)
Ammonia (as N), Nitrate/Nitrite (as N), Total Nitrogen (as N)
Chlorophyll *a*

Won't New Septic Systems Help?

- Somewhat, but a new Title-5 compliant septic system DOES NOT itself remove nitrogen and phosphorus!
- Nitrogen compounds dissolve and move, Phosphorus is adsorbed by loamy and clay soils – if you have them.
- Extra treatment can remove N, P from leachate

Introduction – E. Dudley Septic Study

- Purpose – To Summarize a SWQC Study of Select Dudley Pond Septic Systems
- What's to be covered (20 minutes)
  - Background
    - The Symptoms
    - The Problem
  - Septic System Study
    - Why Dudley Pond?
    - What was done?
    - Results
    - Recommendations
  - Conclusions
- Q & A

Background - Symptoms

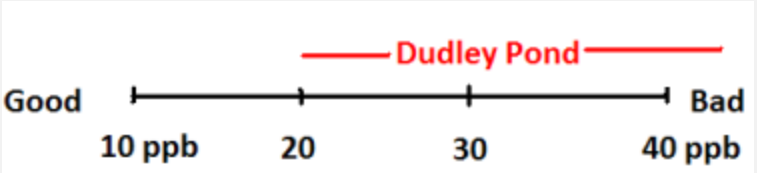
- Excessive amounts of algae and weeds (Milfoil) fueled by high phosphorus (P) concentrations
- Loss of recreational & aesthetic values
- MA DEP designation Category 5 Impaired Water Body (organic enrichment, low DO, turbidity and exotic species)

Background: Costs since 1980

Program	Funding Source	Cost
Chemical treatments: 1968, 1970, 1974,1976,1977,1978	ToW, MA DEQE	unknown
Hydro-raking: 1981, 1983, 1984,1985, 1986, 1987, 1989	Unknown	unknown
Pave, Grade, Drains –Stormwater Improvements	75% EPA, 25% ToW	$540,000
Drainage Middle School	90% DEP, 10% ToW & DPA	$70,000
Water Circulators	ToW (CPA)	$35,000
Diver Hand Pulling	ToW 47%, DPA 25%, MA 28%	$116,000
Herbicide	ToW 46%, DPA 43%, MA 11%	$179,000
Weevils	MA 100%	$25,000
Mechanical Harvesting	MA 100%	$25,000
TOTALS	ToW 31%, DPA 11%, MA 58%	$990,000

Some data may be missing, some data area approximations.

Background – The Problem



- Phosphorus Concentrations
- Major P Sources need to be identified, quantified & minimized
  - Rainwater runoff – 2007 study completed, quantities can be estimated, watershed mailings completed
  - Septage – Need to identify, quantify & minimize this source
- Weed Nutrient Pandemic – Dudley Pond not unique

One Person's Septage (1 – 1.5 lb Phosphorus/yr) = 1,900 lbs/year wet weeds = $267/year of DPA/TOW Funds

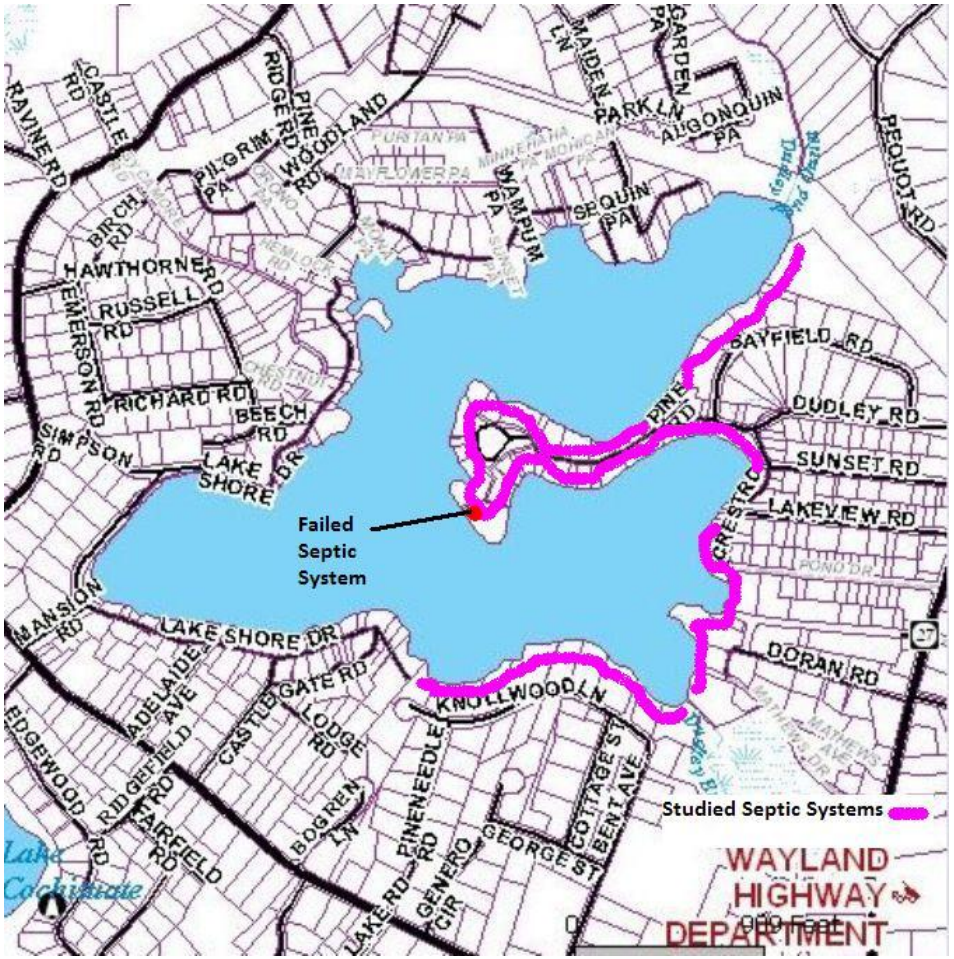
Dudley Pond Septic Study

- **Why Study Dudley Pond Septic Systems?**
  - $$$$$ Largest annual TOW/DPA weed management expenditures
  - Density of abutting houses & septic systems (106)
  - EPA estimates 25% failure rate of MA septic systems
  - Little existing Dudley Pond Septic information

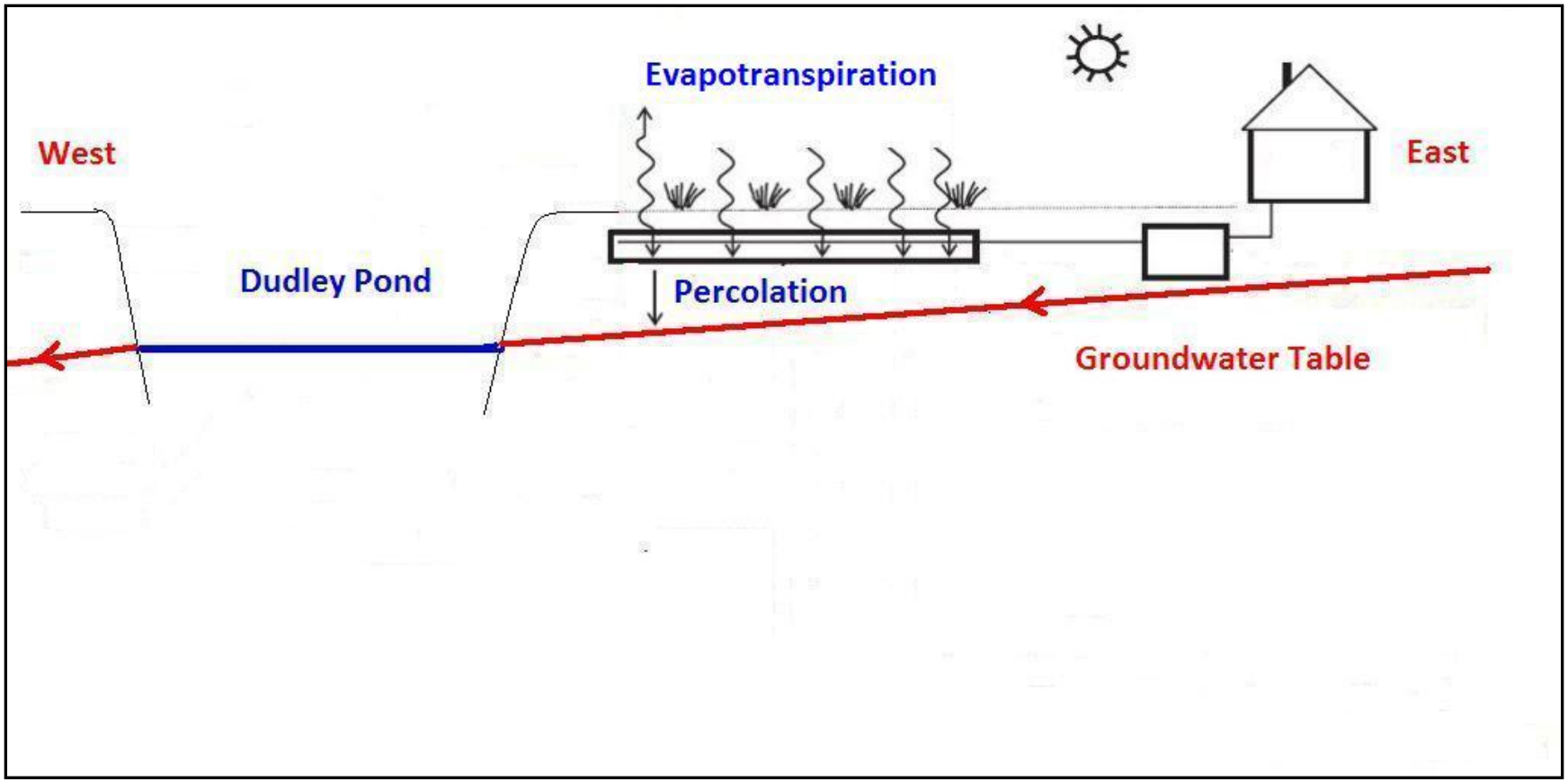
Dudley Pond Septic Study
Septic Systems Studied

Why study abutters on east side?

- Density of septic systems - 50/106
- Groundwater hydrology



Dudley Pond Groundwater Hydrology



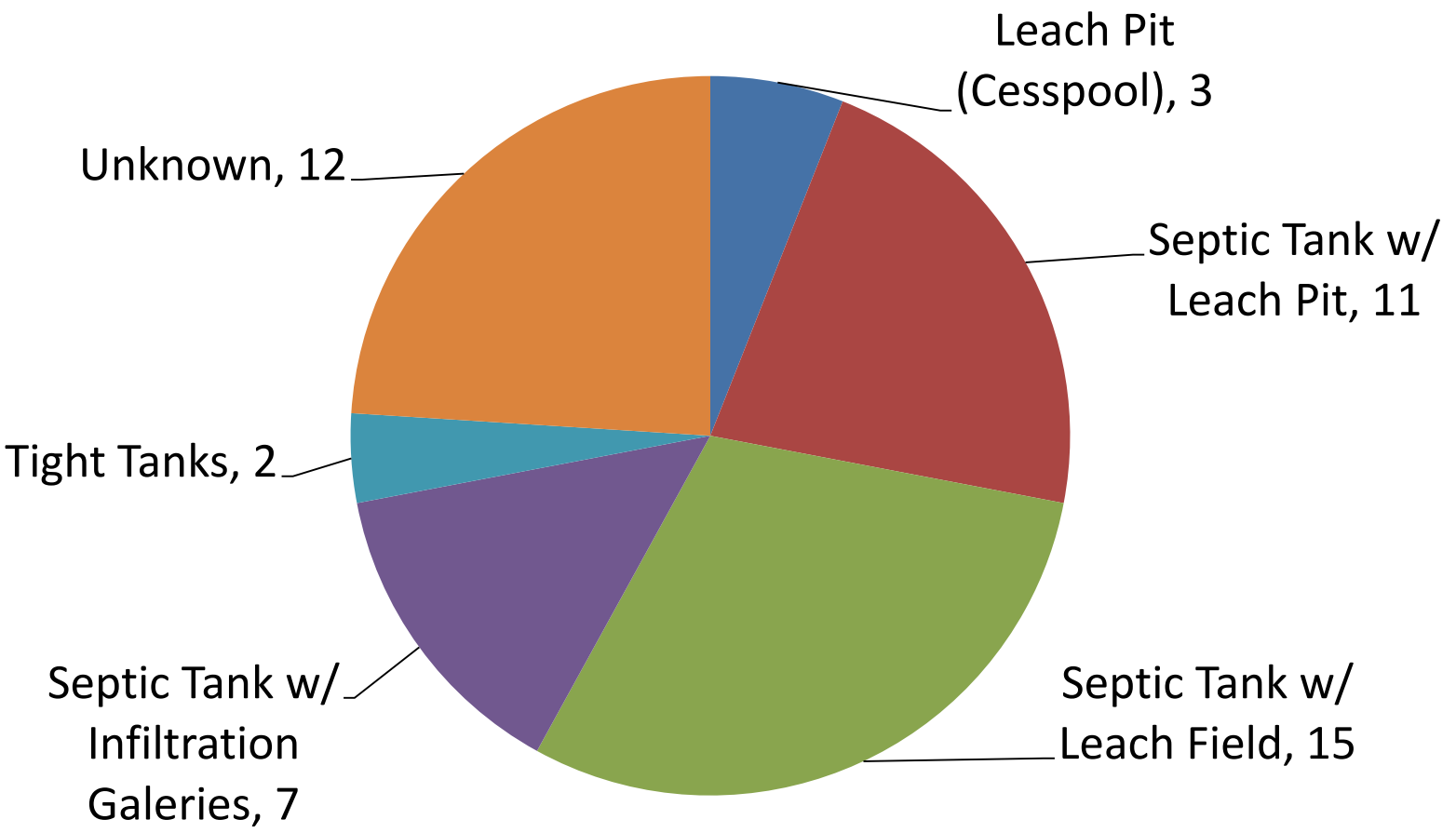
Data Gathered & Sources

Data Item	Source
Addresses & Owner	TOW Maps & Voter Reg.
Number of systems users	Voter Registrations
Water usage – 2 year average	BoPW files
Septic System Types	BoH files
Ages of Septic Systems	BoH files
Systems with MA 'Title V'	BoH files
Proximity of Groundwater	BoH files
Percolation Rates	BoH files
Distance from Pond	BoH files
Year Last Pumped	BoH files

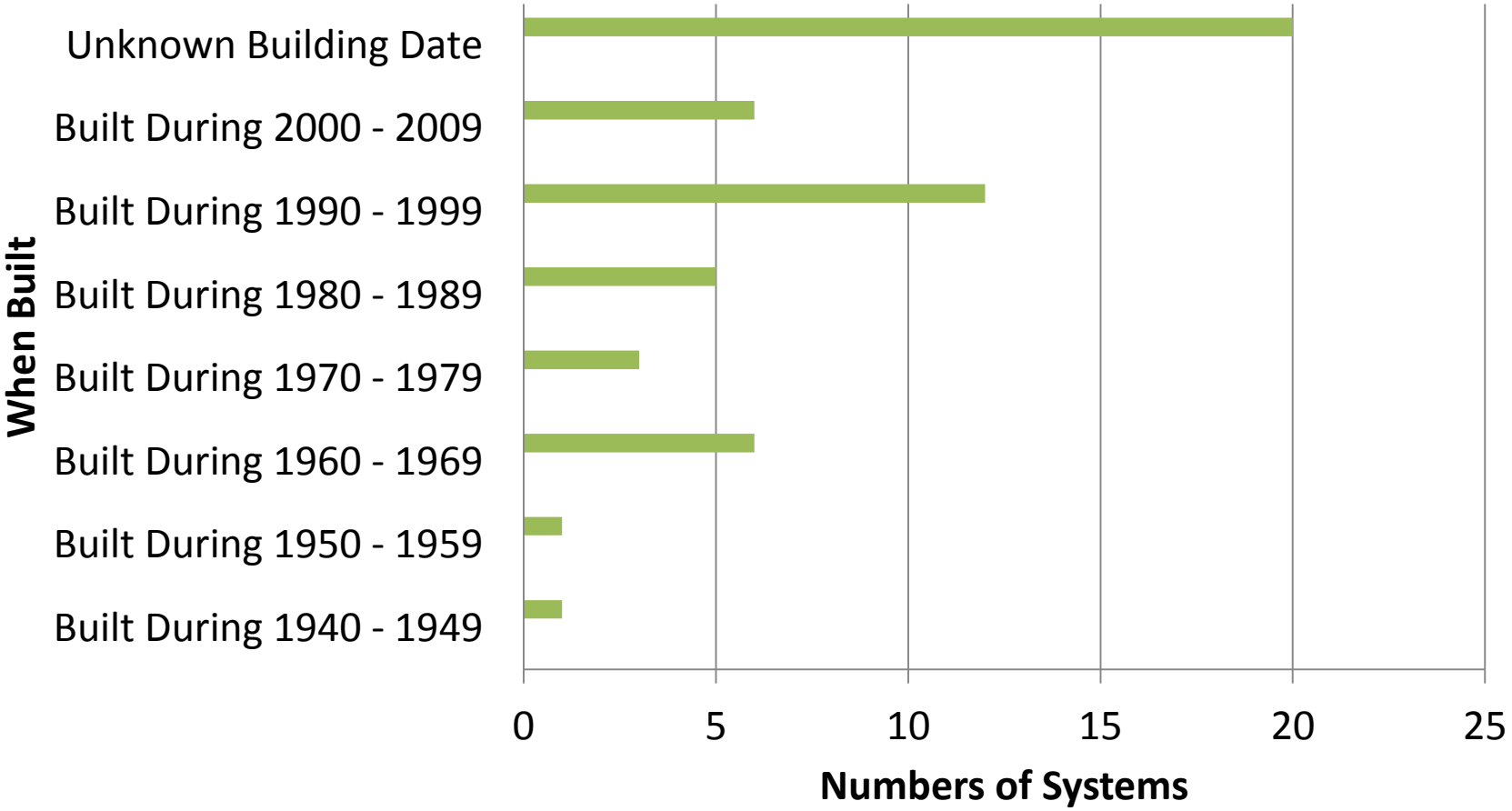
Results - Statistics

- Number of systems studied - 50 out of 106
- Number of system users – 103 +/-
- Pounds per year of Phosphorus – 155 lbs +/-
- Water Usage (Avg. last 2 years)
  - 50 – 14,900 cubic feet per/yr
  - 374 – 111,500 gallons per year
  - Average household - 5,400 cu ft/yr (40,600 gal/yr)
  - Average per capita usage – 54 gal/person/day

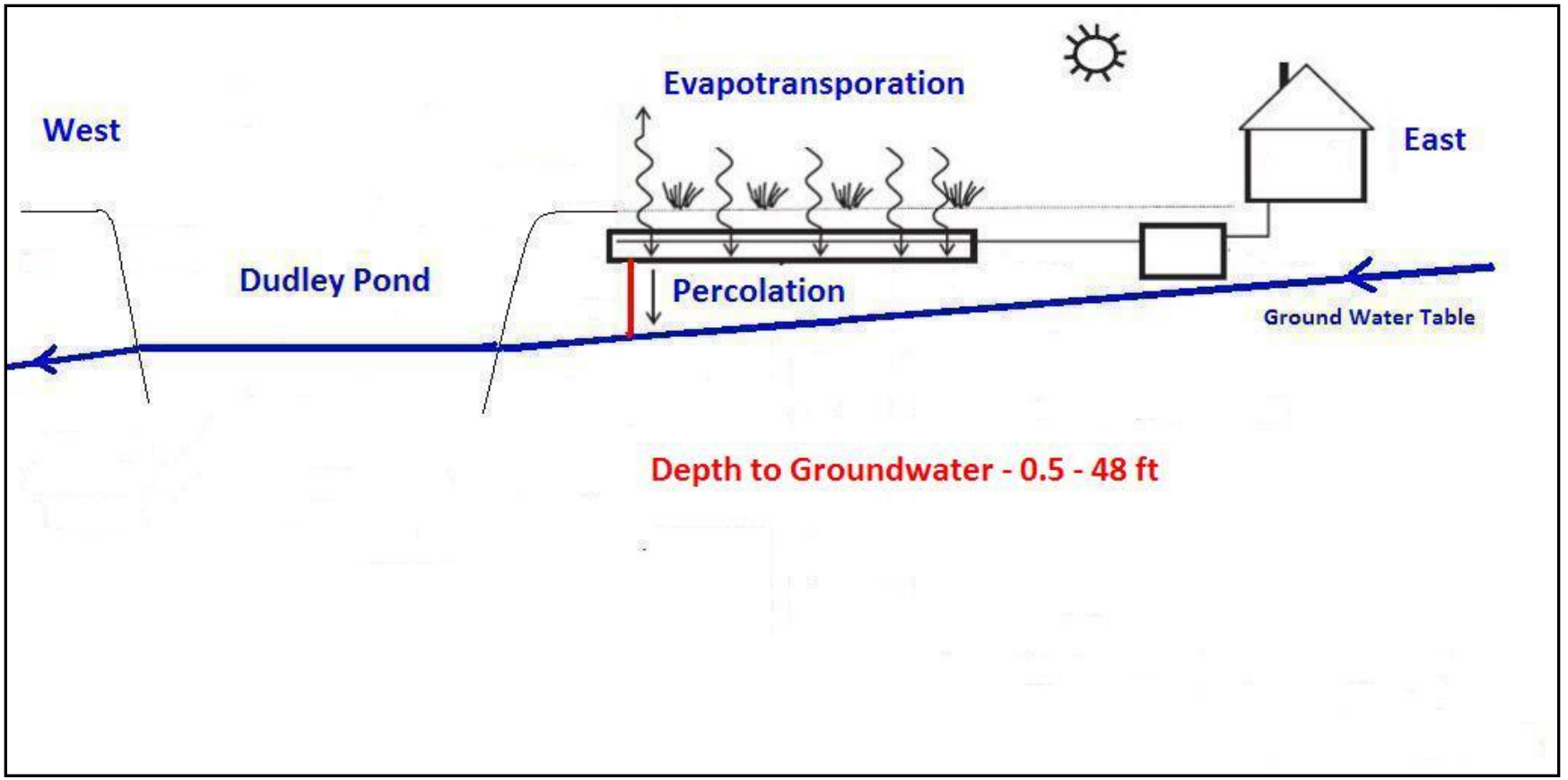
Results:
System Types & Numbers



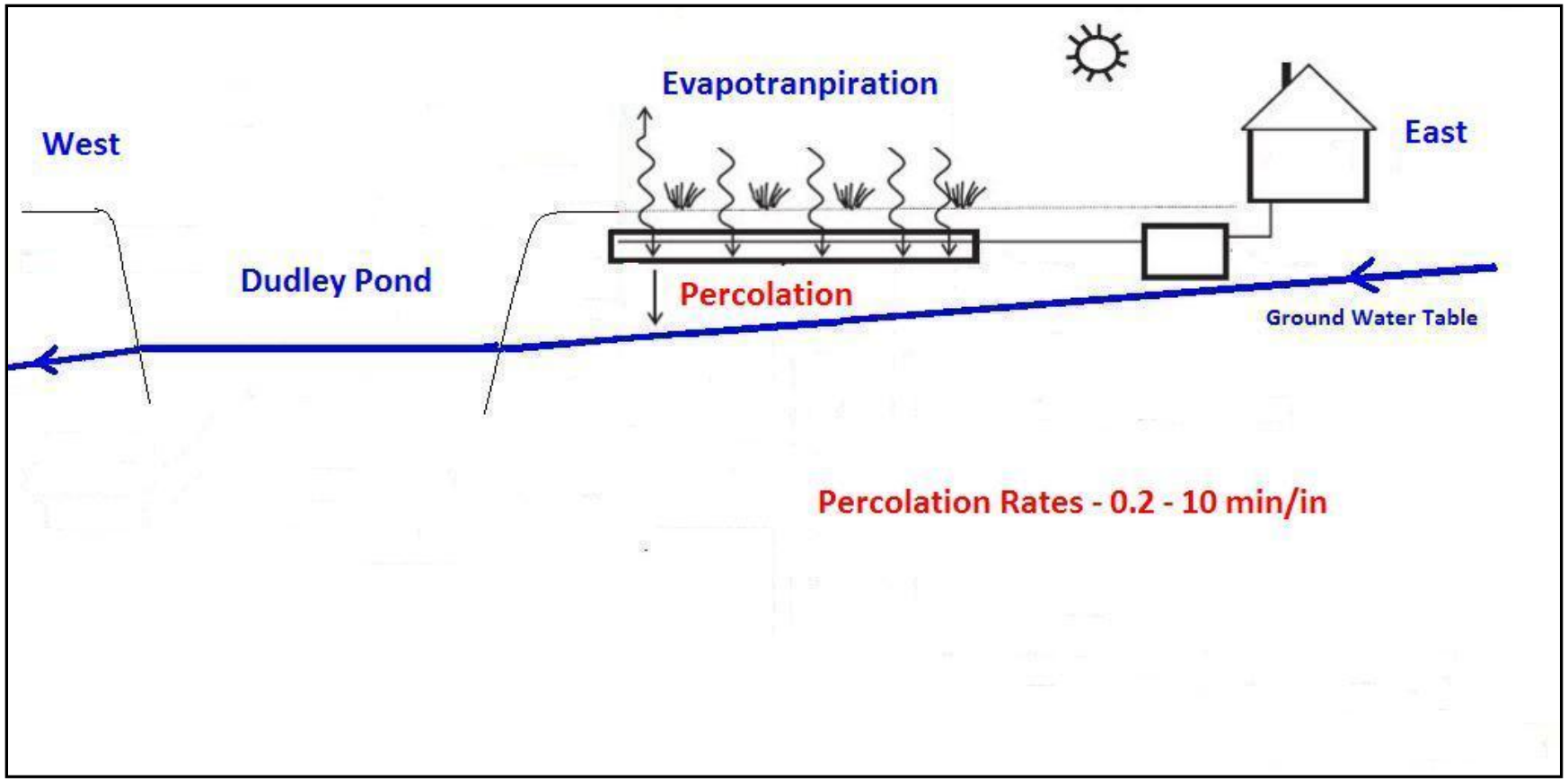
Results:
Systems Ages



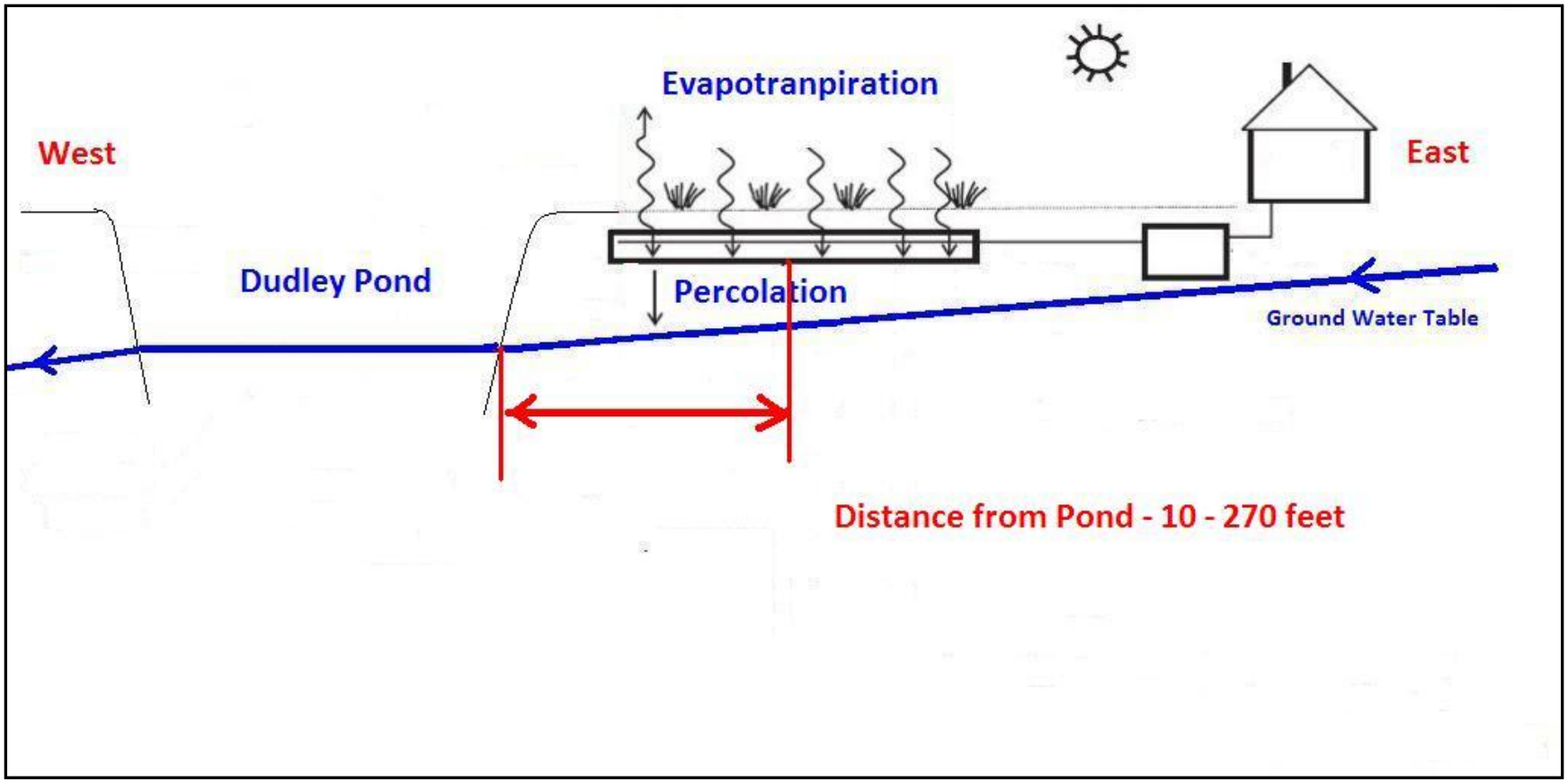
Results:
Depth to Groundwater



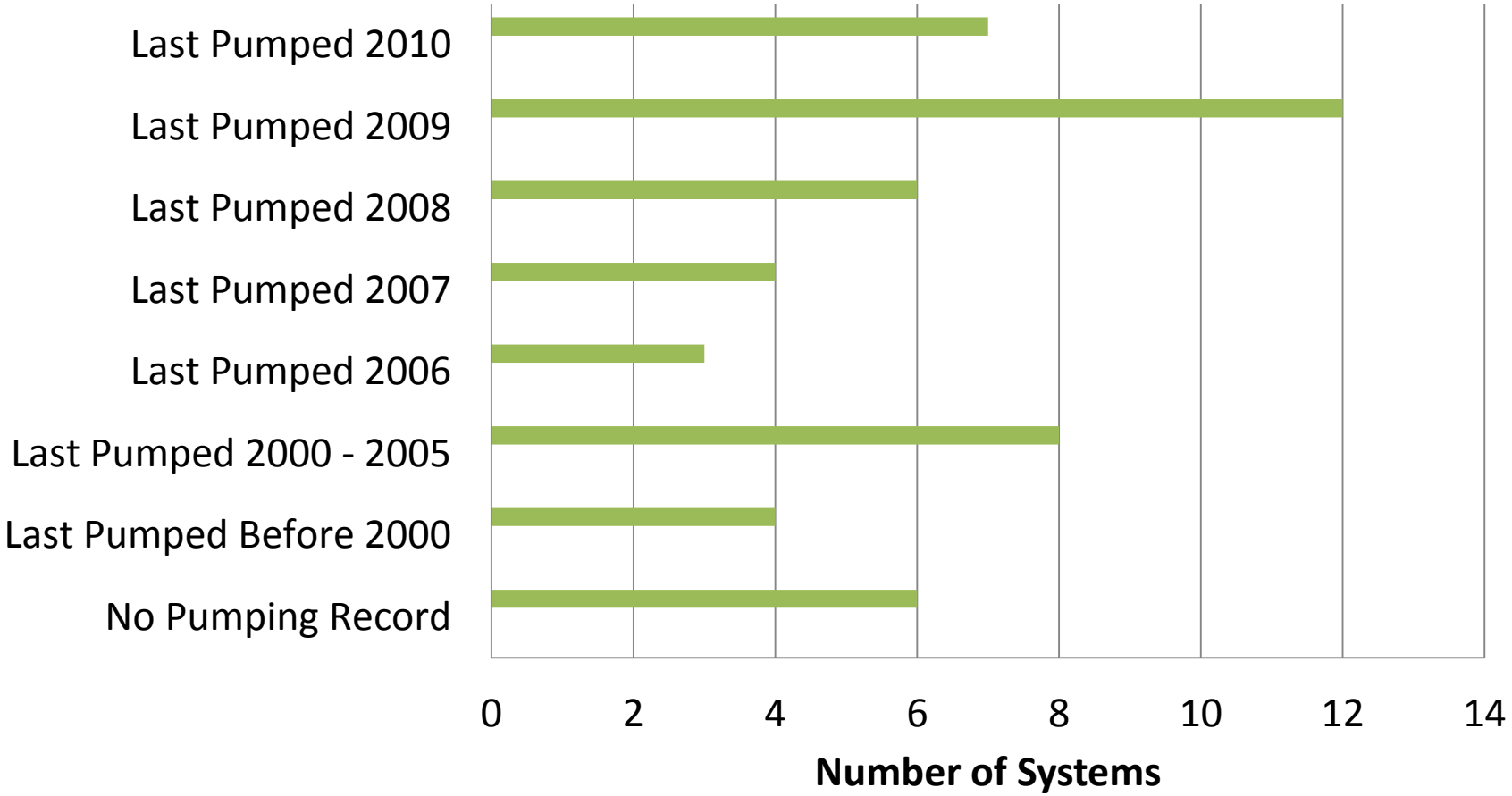
Results:
Percolation Rates



Results:
Distance from Pond



Results:
Pumping Records



Septic Scoring

SCORING FUNCTIONS

Legend	Score	Type
?	8	Unknown
Failed	50	Leaking
LP	10	Cess Pool
ST-IG	6	Septic tank Infiltration gallery
ST-LF	2	Septic Tank Leach field
ST-LP	4	Septic Tank Leach Pit
Tight	5	Tank that accumulates sewage and is periodically pumped

New Date	Score
?	10
1900	10
1960	9
1970	8
1980	7
1990	6
2000	5
2005	3
2010	1
2015	0

Title V	Score
?	10
N	8
Y	0

Drawing	Score
N	10
Partial	5
Y	0

Perc m/in	Score
0.1	8
1	6
2	4
5	2
10	1

Ft to Pond	Score
?	10
0	9
25	8
50	7
75	6
100	5
125	4
150	3
175	2
200	1

Pumped	Score
?	10
1985	10
1999	8
2000	6
2002	5
2004	4
2006	3
2008	2
2009	1
2010	0
2015	0

Leach-GW	Score
0	10
4	9
6	8
8	7
10	6
12	5
14	4
16	3
18	2
20	1
100	0

B	C	D	E	F	G	H	I	J	K	L	M	N
Weighting Factors		2.5		1.0		1.0		1.0		1.0		0.3
Name	People	People-score	cu ft/yr	WaterUse-score	SysType	Type-score	NewDate	New-score	Title-V	TitleV-score	Drawing	Drawing-score

O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
				1.0		0.5		1.5		2.0		
Grade-EL	GW-EL	Leach-EL	Leach-GW	Prox-score	Perc m/in	Perc-score	Ft to Pond	Dist-score	LastPump	Pump-score	#P/yr	TOTAL-SCORE

Septic Scorecard

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		*Weighting Factors*		2.5		1.0		1.0		1.0		1.0		0.3
2	Address	Name	People	*People-score*	cu ft/yr	WaterUse-score	SysType	Type-score	NewDate	New-score	Title-V	TitleV-score	Drawing	Drawing-score
3	125 Dudley Road	Pauplis on 123's lot	3	*6*	9200	*6.13*	Failed	*50*	?	*10*	N	*8*	N	*10*
4	6 Crest Road	Mahlowitz	5	*10*	11250	*7.50*	ST-LP	*4*	1980	*7*	N	*8*	Y	*0*
5	45 Mathews Drive	Griggs	4	*8*	5250	*3.50*	ST-LP	*4*	1962	*9*	N	*8*	Y	*0*
6	48 Pond Drive	Portyrata	5	*10*	7300	*4.87*	ST-LF	*6*	?	*10*	N	*8*	Y	*0*
7	8 Crest Road	Young	1	*2*	1400	*0.93*	?	*8*	?	*10*	N	*8*	N	*10*
8	18 Crest Road	Santaspago	3	*6*	8300	*5.53*	ST	*10*	?	*10*	N	*8*	N	*10*
9	25 Bayfield Road	Mitnik	3	*6*	9750	*6.50*	ST-LF	*6*	1975	*8*	N	*8*	Partial	*5*
10	119 Dudley Road	Pompeo	2	*4*	2500	*1.67*	?	*8*	1991	*6*	N	*8*	N	*10*
11	23 Knollwood Lane	Leung	3	*6*	10950	*7.30*	ST-LP	*4*	?	*10*	N	*8*	N	*10*
12	33 Bayfield Road	Morss	5	*10*	11550	*7.70*	ST-LF	*6*	2005	*3*	N	*8*	Y	*0*
13	12 Crest Road	Beaulieu	1	*2*	3400	*2.27*	ST-LF	*6*	1985	*7*	N	*8*	Y	*0*
14	47 Pond Drive	Merette	3	*6*	14900	*9.93*	ST-IG	*6*	1992	*6*	N	*8*	Y	*0*

	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
					1.0		0.5		1.5		2.0		
	Grade-EL	GW-EL	Leach-EL	Leach-GW	Prox-score	Perc m/in	Perc-score	Ft to Pond	Dist-score	LastPump	Pump-score	#P/yr	TOTALS SCORE
	173	150	163	13.0	5	2	*4*	?	*10*	2009	*1*	4.5	***115.6***
	161	150	153	3.0	10	2	*4*	70	*7*	1995	*10*	7.5	***94.0***
	160	157	158.5	1.5	10	0.2	*8*	70	*7*	?	*10*	6	***89.0***
	166	150	160	10.0	6	2	*4*	270	*1*	?	*10*	7.5	***83.4***
	166	150	158	8.0	7	2	*4*	?	*10*	1992	*10*	1.5	***78.4***
	156	150	153	3.0	10	2	*4*	?	*10*	2010	*0*	4.5	***78.0***
	156	150	153	3.0	10	2	*4*	?	*10*	2009	*1*	4.5	***73.8***
	164	150	157	7.0	8	2	*4*	?	*10*	2001	*6*	3	***73.2***
	190	150	184	34.0	1	2	*4*	?	*10*	2004	*4*	4.5	***72.8***
	159.6	152.8	156.1	3.3	10	2	*4*	100	*5*	2009	*1*	7.5	***71.2***
	164	150	154	4.0	9	2	*4*	70	*7*	?	*10*	1.5	***69.8***
	159.4	150.5	154.5	4.0	9	2	*4*	100	*5*	2007	*3*	4.5	***69.4***

Clickable Septic Data Map

29 Bayfield Road

EastDudley:**Address**	29 Bayfield Road
EastDudley:**Name**	Salitzky
EastDudley:**People**	3
EastDudley:**People-interest**	6
EastDudley:**cu ft/yr**	10800
EastDudley:**WaterUse-Interest**	7.2
EastDudley:**SysType**	ST-LF
EastDudley:**Type-interest**	6
EastDudley:**NewDate**	1988
EastDudley:**New-interest**	7
EastDudley:**Title-V**	N
EastDudley:**TitleV-interest**	8
EastDudley:**Drawing**	Y
EastDudley:**Drawing-interest**	0
EastDudley:**Grade-EL**	159
EastDudley:**GW-EL**	151
EastDudley:**Leach-EL**	155
EastDudley:**Leach-GW**	4
EastDudley:**Prox-interest**	9
EastDudley:**Perc m/in**	2
EastDudley:**Perc-interest**	4
EastDudley:**Ft to Pond**	120
EastDudley:**Dist-interest**	5
EastDudley:**LastPump**	2009
EastDudley:**Pump-interest**	1
EastDudley:**#P/yr**	4.5
EastDudley:**TOTAL-INTEREST**	63.7
EastDudley:**RANK**	19

Directions: To here - From here

Study Recommendations

- Review with - BoH, DPA, ConCom, Planning Board & BoS
- Systems with high scores - reviewed and choose actions
- Continue public education programs
- Complete a study (TMDL) to:
  - Determine max permissible daily phosphorus load for Pond
  - Identify relative sizes of sources (Runoff vs. Septic)
  - Identify phosphorus minimization opportunities
- Continue to seek grants to fund TMDL study
- Consider watershed by-laws re septic systems and landscape fertilizer use
- Expand the study to include systems between Dudley Pond and Route 27 (99 additional properties)
- Fund consultant study to understand east Dudley Pond sewerage management options

Study Conclusions

- Dudley Pond's symptoms are telling us the existing nutrient (phosphorus) load is too large.
- Public education and participation must increase.
- The symptoms (weeds) will continue to need annual funding and management .
- Our understanding of this problem needs to be refined.
- Phosphorus from septic systems and surface water runoff need to be reduced

Thanks for your attention & your efforts.

Wayland Surface Water Quality Committee

Memorandum

Date: January 24, 2011

To: Board of Health
Board of Selectmen
Conservation Commission
Dudley Area Advisory Committee
Dudley Pond Association

From: Surface Water Quality Committee

Subject: East Dudley Pond Watershed Septic System Study Report

This report summarizes a study of phosphorus discharges associated with septic systems located on properties abutting the eastern shore of Dudley Pond. The objective of this study was to begin the process of minimizing the negative impact of septic systems on the water quality of Dudley Pond. This memo contains a summary, recommendations, background information, study methods, results and a discussion of the results as well as an appendix containing data gathered during the study.

Summary

- Dudley Pond is a Massachusetts Category 5 (worst) impaired water body, contains excessive concentrations of weed fertilizing nutrients (phosphorus) and costs the Town of Wayland (TOW) and the Dudley Pond Association (DPA) many thousands of dollars annually for weed maintenance to keep the Pond usable for recreation, free of fish kills and noxious odors.

- Phosphorus, associated primarily with surface water runoff and ground water is generally accepted as the limiting nutrient for weed growth in fresh waters.

- The major sources of phosphorus entering the Pond are thought to be primarily from septic systems and secondarily from surface water runoff.

- All of Wayland is serviced by septic systems, 106 of which are located on small lots abutting Dudley Pond and are very close to the Pond.

- The ground water elevation on the east side of the Pond is higher than the Pond water elevation, therefore any effluents from septic tanks on the east side of the Pond that intersect the ground water table most likely flow into the Pond.

- The findings from this study are:
    - 50 septic systems are located on the east side of Dudley Pond, with ages ranging from one to sixty seven years old, with an average age of 24 years for the systems where BOH records exist. It is generally accepted that septic systems have finite life of 20 – 30 years.
    - The types, age and location of 15 of these septic systems are unknown because no drawings exist in the TOW Board of Health (BOH) files.

- 103 +/- (college students away) residents live in houses abutting the Pond and are served by septic systems in the east Dudley Pond watershed, the effluents of which collectively contain approximately 155 pounds per year of phosphorus.
- 8 of these septic systems have had a Massachusetts Title 5 inspection.
- Annual water usage of these 50 properties ranges from 50 – 14,900 cubic feet per year (374 – 111,452 gallons per year) with the average household usage 5,400 cubic feet per year (40,600 gallons per year) and the average per-capita usage of approximately 54 gallons per person per day.
- Because of the small lot size and high ground water elevation in this area many of the septic systems are located close to Dudley Pond and the elevations of the septic system leach areas are close to the elevation of the ground water, which increases the probability of contaminating ground water and subsequently the Pond.
- The soils in the Dudley Pond east watershed are predominantly sandy, are very permeable and do not readily adsorb and retain phosphorus compounds.
- Of the 50 septic systems 7 systems do not have records of being pumped at all. The average time elapsed since the last pumping for the systems that had records was 4 years. There are 2 "tight" tanks amongst the 50 septic systems, both of these properties appear to have used significantly more water than their tanks can hold.
- One septic system connected to a rental property with three inhabitants failed during the summer of 2010. The TOW BOH is pursuing the situation.

Recommendations

The following are recommendations resulting from the study:

1. As stated in Wayland's Master Plan, "To address this concern [Dudley Pond] a more proactive approach toward minimizing septic system problems on private lots is recommended".

2. This study should be reviewed with the TOW BoH, DPA, Conservation Commission, Planning Board, and the Board of Selectmen (BoS).

3. For the properties where no septic system drawings and/or where pumping records are old or do not exist (15 – 20 systems) it is recommended that the BOH require that a Title 5 equivalent inspection be completed as soon as possible and a Title 5 equivalent inspection timetable be established for the balance of the systems.

4. Further Surface Water Quality Committee (SWQC) reviews need to be undertaken for septic systems with high scores resulting from this study and for systems where information such as plot plans, construction dates, pumping records are missing from BOH files.

5. Inconsistencies between water use records and tight tank pumping records need to be resolved by BOH/SWQC.

6. It is recommended that the TOW adopt a by-law that requires septic systems within the Dudley Pond watershed to be pumped at a minimum of every 3 years.

7. The SWQC should work with the BOH to obtain funding from Massachusetts Water Pollution Abatement Trust for septic system tracking software and to pay municipal employees to gather and track septic system data. For more information on this visit: http://www.wickedlocal.com/mendon/news/x1799252093/Mendon-may-join-septic-system-loan-program

8. The SWQC should continue to seek grants to in order to complete a federal and state-mandated Total Maximum Daily Load (TMDL) for phosphorus study, the objective of which is to determine the maximum amount of phosphorus that can be discharged to Dudley Pond under the State's water quality standards and develop a plan to meet that goal. Such a TMDL would be required to form a rational basis for TOW Dudley Pond watershed by-laws.

9. A public education program regarding nutrient management should be continued in the Dudley Pond watershed, with the highest priority being the eastern part of the Dudley Pond watershed.

10. An additional study of septic systems, ground water elevations and ground water/soil phosphorus concentrations should be undertaken on the properties between Dudley Pond and Route 27 by the SWQC. This study may be later extended to the entire Dudley Pond watershed, the Lake Cochituate and Sudbury River watersheds in Wayland, and the Heard Pond watershed.

11. The SWQC should prepare draft by-laws for Dudley Pond and other Wayland watersheds, modeled after other Massachusetts communities' nutrient management by-laws, for consideration by the Board of Health, Conservation Commission, Planning Board, Board of Selectmen, and interested watershed associations.

12. The TOW should commission a study of the following alternatives:
    a) A sewer system and community advanced (nutrient removal) treatment system for the properties in the east Dudley Pond watershed, at a location to be determined.
    b) A sewer system for the east Dudley Pond watershed that connects with the MWRA pump station located at the intersection of the Mass Pike and Route 27.

Background

This study was undertaken by the Wayland Surface Water Quality Committee (SWQC) because:

- The State of Massachusetts has designated Dudley Pond is a Category 5 impaired water body due to organic enrichment, low dissolved oxygen, turbidity and exotic species (Eurasian Milfoil). Range of categories 1 – 5, with 5 being the worst - Table 1 below.

- The high nutrient concentrations in Dudley Pond are the 'root cause' of excessive growth of aquatic weeds and algae. The Town of Wayland (TOW) and the Dudley Pond Association (DPA) have spent significant amounts of money for weed management in Dudley Pond over the past 30 years.

- The aquatic weed that is the major symptom of the problem in Dudley Pond is Eurasian Milfoil. Fortunately, to date, there has not been a documented blue-green algae bloom in Dudley Pond,

despite the fact that there was a blue-green algae bloom “epidemic” in the northeast during the summer of 2009. The reasons for the epidemic are not known.

Massachusetts Category 5 Waters
"Waters requiring a TMDL"

NAME	SEGMENT ID	DESCRIPTION	SIZE	POLLUTANT NEEDING TMDL [EPA APPROVAL DATE-DOCUMENT CONTROL NUMBER]
Lake Cochituate (82126)	MA82126_2008	[Carling Basin] Natick	14.3 acres	-Priority organics -(Exotic species*)
Lake Cochituate (82127)	MA82127_2008	[South Basin] Natick	240 acres	-Priority organics -Organic enrichment/Low DO -(Exotic species*)
Concord River (8246500)	MA82A-07_2008	From the confluence of the Assabet and Sudbury rivers, Concord to the Billerica Water Supply intake, Billerica.	10.4 miles	-Metals -Nutrients -Pathogens -(Exotic species*)
Concord River (8246500)	MA82A-08_2008	From the Billerica Water Supply intake, Billerica to Rogers Street bridge, Lowell.	5.1 miles	-Metals -Nutrients -(Exotic species*)
Concord River (8246500)	MA82A-09_2008	From the Rogers Street bridge, Lowell to the confluence with the Merrimack River, Lowell.	0.90 miles	-Metals -Nutrients -Pathogens -Noxious aquatic plants -(Objectionable deposits*)
Dudley Pond (82029)	MA82029_2008	Wayland	83.2 acres	-Organic enrichment/Low DO -Turbidity -(Exotic species*)
Eames Brook (8248125)	MA82A-13_2008	From the outlet of Farm Pond, Framingham to the confluence with the Sudbury River, Framingham.	0.57 miles	-Cause Unknown -Taste, odor and color -Noxious aquatic plants -(Exotic species*) -(Objectionable deposits*)
Elizabeth Brook (8247150)	MA82B-12_2008	From the outlet of an unnamed pond (Delaney Project on Stow/Harvard border) west of Harvard Road, Stow to the inlet of Fletchers Pond, Stow.	3.7 miles	-Cause Unknown
Farm Pond (82035)	MA82035_2008	Framingham	140 acres	-Noxious aquatic plants -Turbidity -(Exotic species*)
Fort Meadow Reservoir (82042)	MA82042_2008	Marlborough/Hudson	248 acres	-Pesticides -Nutrients -(Exotic species*)
Framingham Reservoir #1 (82044)	MA82044_2008	Framingham	118 acres	-Metals -(Exotic species*)
Framingham Reservoir #2 (82045)	MA82045_2008	Framingham/Ashland	114 acres	-Metals -Turbidity
Grist Mill Pond (82055)	MA82055_2008	Sudbury/Marlborough	16.7 acres	-Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants -(Exotic species*)

Table 1 – Massachusetts Partial Category 5 List

- It is generally accepted that any aquatic weed/algae management program should be comprised of two parts:
  1) Managing weeds and algae (symptoms of the problem) on a year to year basis, and
  2) A long range program to minimize the amount of weed nutrients entering the pond.

- Previous studies [(1)] of Dudley Pond have indicated that ground water flows into Dudley Pond on the east side of the Pond and out of the Pond on the west side of the Pond.

- With the exception of two properties all (106) residential properties abutting the Pond dispose of sanitary sewage via either septic systems or cesspools, which can, under ideal circumstances, remove the nutrients contained in the leachate.

- Based on past Dudley Pond studies, SWQC has data that allows estimates of the phosphorus load on Dudley Pond from rain water runoff: 2007 Watershed Nutrient Load Sampling and Assessment (Geosyntec)

- This study is the first step in an attempt to understand and quantify the possible Dudley Pond phosphorus load coming from septic systems in important portions of the Dudley Pond watershed.

- During 2009 the SWQC submitted a grant application to the State for funding to complete a FY 2010 phosphorus total maximum daily load (TMDL) study, which was not funded. The objectives of a TMDL would be to identify and quantify the sources of phosphorus entering Dudley Pond, the maximum phosphorus load that the Pond can tolerate and make recommendations as to how to minimize the sources. The 1983 IEP Dudley Pond report was a TMDL for that point in time and indicated that surface water runoff was the largest source of phosphorus compounds entering Dudley Pond. The 1983 IEP report recommended changes in paving and catch basins around the Pond, some of which were completed and are thought to have reduced runoff sources of phosphorus. The objective of the 2009 SWQC TMDL grant application was to update the 1983 IEP study and also provide a scientific/legal basis for TOW watershed by-laws. The grant application can be found by visiting 2010 MA DEP 604b Grant Application - Dudley Pond TMDL. SWQC has updated and resubmitted the application in for FY2011.

- Select Massachusetts communities with similar problems have enacted watershed by-laws to minimize nutrients from surface water runoff and septic systems; however, the SWQC is unable to recommend a Dudley Pond watershed nutrient minimization by-law to the TOW Conservation Commission until we understand the how much phosphorus Dudley Pond can tolerate, how much phosphorus is stored in the Pond sediments and how much phosphorus is entering the Pond annually from surface water runoff and ground water (septic systems). A TMDL study will provide much of this information.

Study Methods

a) Property drawings from the TOW surveyor's office were reviewed to obtain street addresses of the properties abutting the east shore of Dudley Pond (Figure 1 below).
b) Wayland Board of Health (BOH) septic system files were reviewed to gather property owner names, septic system type, date of construction, existence of a Title 5 file, septic system plot plans and elevations, ground water elevations, bottom of leach field elevations, soil percolation

rates, distance of the leach field to Dudley Pond, the most recent date the septic tank was pumped and the date that the septic system data was gathered from the BOH files.

c) The Wayland Department of Public Works supplied water usage records for the addresses of the properties abutting the east shore of Dudley Pond. Annual average water use was calculated based on the two most recent years of usage.

d) The Wayland Town Clerk's office provided voter listing data for the properties abutting the east shore of Dudley Pond.

e) Since the TOW was not allowed to disclose the number of people that are eighteen years old or less inhabiting the subject properties, a summary of the raw data collected was distributed to Dudley Pond abutters to verify the number of people living in each of the houses on the properties abutting the eastern shore of Dudley Pond.

f) Based on the number of people living in the houses abutting the eastern shore of Dudley Pond the yearly load of sewage borne phosphorus was estimated based on data from Ohio State University, the US EPA and the United Nations. A septic system score was calculated based on the formula below.

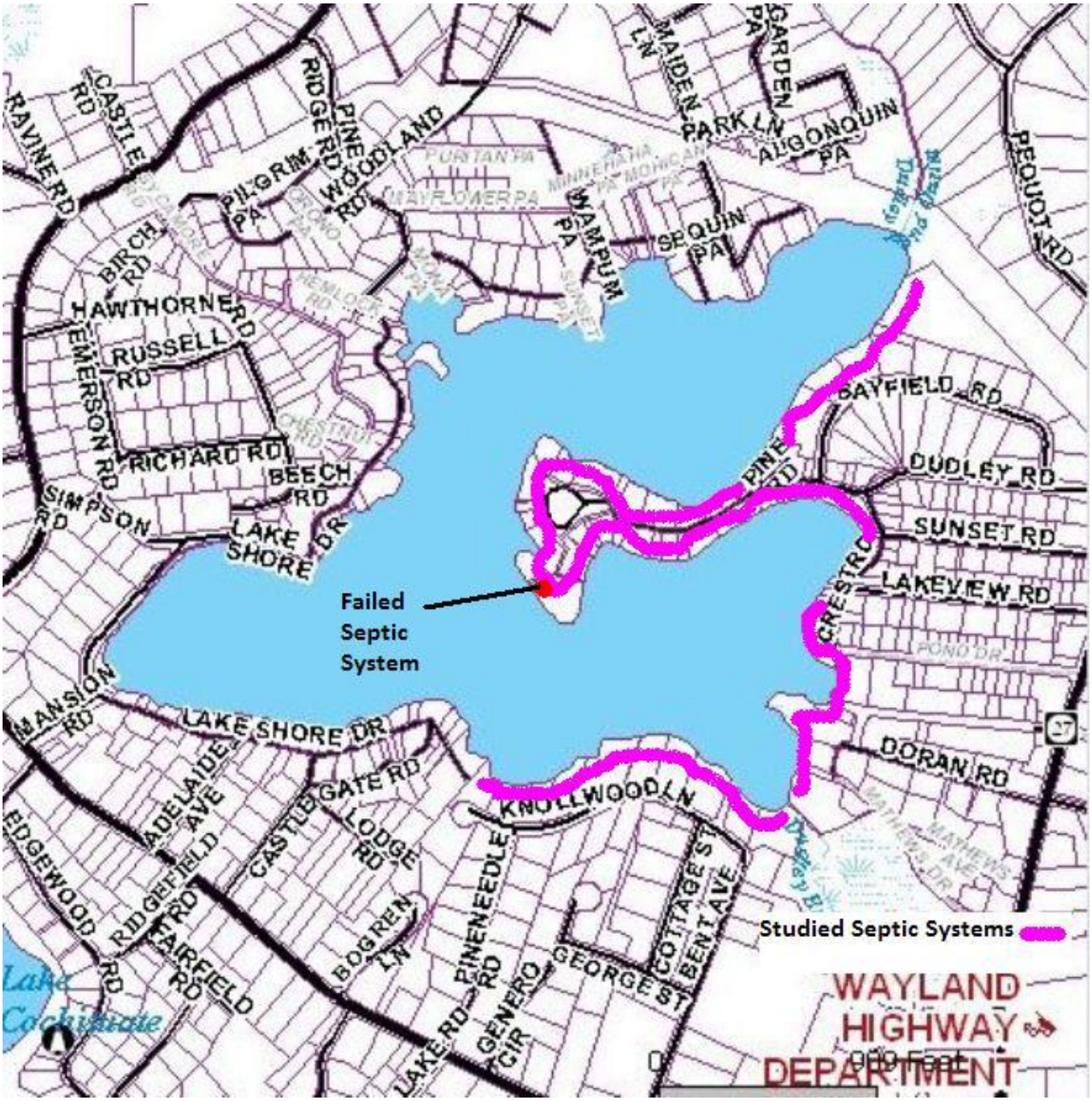


Figure 1 – Locations of Septic Systems Studied

A weighted 'interest scoring' model based of these factors was used to prioritize systems which need further attention.

FACTORS CONSIDERED:

a) Number of persons in the dwelling
b) Cubic Feet of water billed per year
c) Type of septic handling system
d) Construction date of septic system
e) Existence of a Title-V inspection on file with the BoH
f) Existence of a drawing/plan locating and describing the system on file with the BoH
g) Vertical separation between the leaching system and groundwater
h) Percolation rate
i) Distance from the leaching system to the pond
j) Last pump-out date

Each factor was ranked on a 0-10 scale (a higher rank represented a higher likelihood of a nutrient contribution. Some properties had no available file. In others there was missing data. Some groundwater elevations were estimated. Where the leaching system depth was unknown, it was assumed to be at half the distance to groundwater not exceeding 10'. Missing data was scored pessimistically.

Next, each factor was assigned a weight based on how important it was considered to be. For example: The score for the number of persons in the house was more heavily weighted than whether or not there was a drawing.

All factors x their weightings were totaled by parcel; smaller scores represent potentially a smaller source of pollution.

RATIONALES:

- A high water use flushes more phosphorus into the Pond and is therefore a direct function of the potential to pollute.
- An old system has a greater potential to pollute than a new system and is therefore the age of the system is a direct function of the potential to pollute.
- A system that has not been pumped recently has a greater potential to pollute than a system that had recently been pumped and therefore the number of years since the last pumping is a direct function of the potential to pollute.
- A system where the elevation of the bottom of the leach field is close to the elevation of the groundwater has a greater potential to pollute and therefore an inverse function of the potential to pollute.
- A low percolation rate (minutes/inch) is an indication of a soil that has high permeability (granular soil e.g. sand) and therefore fewer sites on which pollutants can adsorb, hence less chance that pollutants will be removed from the sewage and therefore an inverse function of the potential to pollute.

- The potential impact of a septic system that is located a short distance from the Pond is greater than a septic system that is a long distance from the Pond and is therefore distance from the pond is an inverse function of the potential contribute phosphorus to the Pond.

The weighted score is an arbitrary numbers, but provides a way to compare the relative pollution potential of the septic systems on the properties abutting the east shore of Dudley Pond. Septic systems with a high score provide a way to prioritize septic systems that need further review as potential sources of Dudley Pond phosphorus contamination. A low score indicates that the septic system is less likely to be a potential source of phosphorus pollution for Dudley Pond.

Results

The data gathered during this study appears in the appendix of this report and this data is summarized in the section.

- **Number of Septic Systems** – 50 septic systems are on properties that abut the east shore of Dudley Pond, 16 of which did not have any drawings in the BOH file, which prevented a preliminary evaluation of these systems.

- **Numbers of People** – 103 people use the septic systems on properties abutting the east shore of Dudley Pond. The number of people that use individual septic systems ranges from 1– 5.

- **Water Usage** - Average water usage for the past two years for these 50 properties ranged from 50 to 14,900 cubic feet per year (374 to 111,452 gallons per year) , with an average household use of approximately 5,400 cubic feet per year per property (40,600 gallons per year). The average per capita usage is approximately 2,600 cubic feet per person per year or 54 gallons per person per day.

- **System Types -** The following are the numbers and types of septic systems found on the properties abutting the east shore of Dudley Pond.

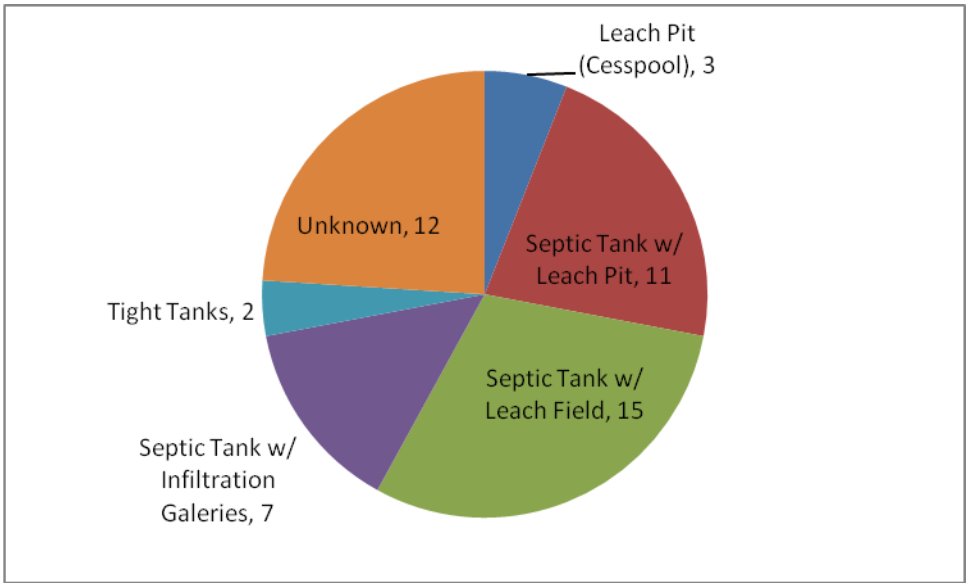


Figure 2 - Types of Dudley Pond Septic Systems

- **Septic System Age -** The ages of septic systems on properties abutting the east shore of Dudley Pond appear in Figure 3 below.

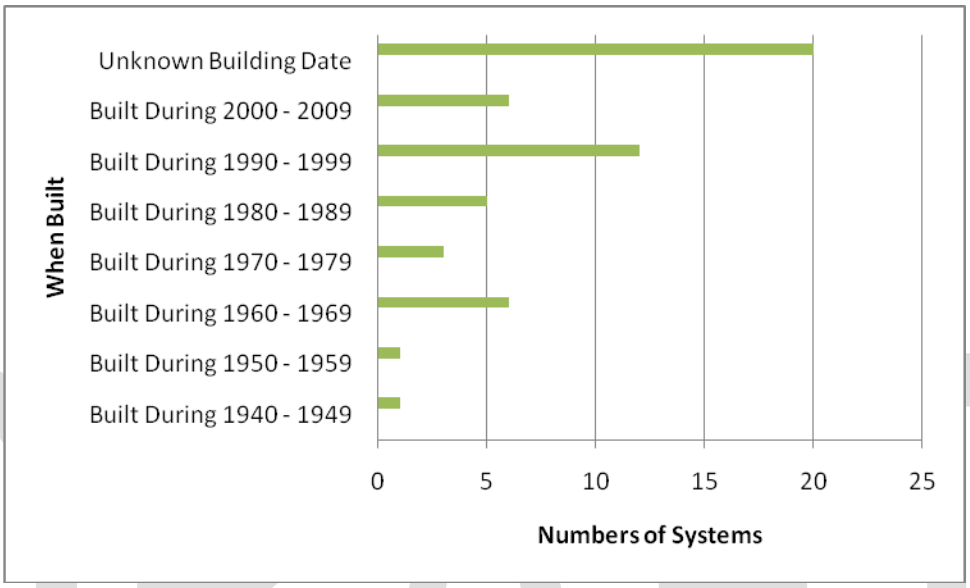


Figure 3 - Ages of Dudley Pond Septic Systems

- **Title V –** Seven of the 50 septic systems studied have had a Massachusetts Title 5 inspection.

- **Proximity to Ground Water** – The greatest separation between the bottom of the leach area and ground water was located on Dudley Rd. with 48 feet of separation between of the elevation of the bottom of the leach area and the ground water table. The least separation was 0.5 feet located on Crest Rd. It should be understood that ground water was not found in test holes of approximately twelve feet and as a result the ground water elevation is not known for most properties on Knollwood Lane and Dudley Rd. Where the depth to ground water is not known, it was assumed that the ground water elevation was the same elevation as the water level in Dudley Pond, which depending on the season is approximately 150 feet. Additionally it should be recognized that the elevation of Dudley Pond varies approximately one foot, depending on the season and rainfall.

  Septic systems located on Mathews, Cross, Pond, Crest, Lakeview and Bayfield, where the grade elevation is close to the ground water elevation, have a limited difference in elevation between the bottom of the leach areas and ground water. There were ten properties on Mathews, Cross, Pond, Crest, Lakeview, Dudley and Bayfield Rd where the ground water has been measured at elevations greater than 150 feet, which supports the information found in the 1983 IEP Report that claims the groundwater elevation is higher than the Dudley Pond water level on the east side of the Pond and therefore ground water flows into the Pond.

- **Percolation Rates** – Most of the measured percolation rates found in the BOH files were 2 minutes/inch. Many files had percolation rates assumed to be 2 min/in or less. Of all the

measured percolation rates there was one measured at 0.2 min/in, one at 0.3 min/in and one at 10 min/in. Where no percolation rate information was available, for septic system scoring purposes, it was assumed that the percolation rate was 2 min/in, which is consistent with the soil types on the east side of Dudley Pond area.

- **Distance from the Pond** – The closer a septic system is to Dudley Pond, the greater the chance for pollution. Of the 50 septic systems reviewed only 34 had plans and elevation drawings on file with the BOH indicating the distance from the Pond. The average distance of the septic systems from the Pond is 97 feet, the minimum distance is 10 feet and the maximum is 270 feet. The property with 270 feet from the septic system to the Pond is on Pond Dr. and the septic tank is located across the street on TOW property.

- **Year Pumped Last** – Of the 50 septic systems reviewed 6 properties did not have pumping records in the BOH files. The average interval between pumping, where records were available, was 3.9 years. The longest interval since the last pumping was 24 years and the shortest interval between pumping was less than a year. Dates of most recent pumping are shown in Figure 5 below.

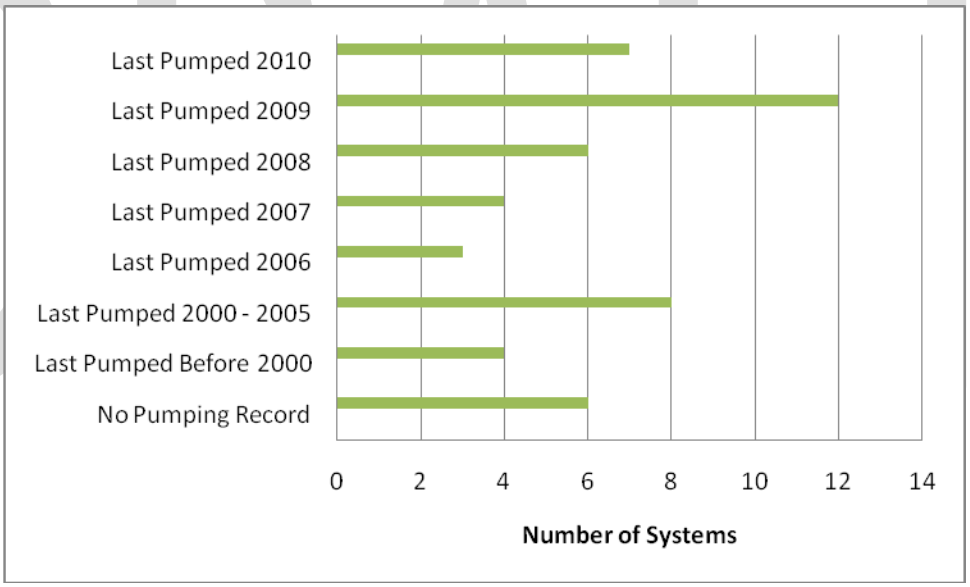


Figure 5 - Most Recent Pumping

- **Pounds of Phosphorus Discharged** – According to the US EPA, Ohio State University and The United Nations:
  http://www.epa.gov/nrmrl/pubs/625r00008/625r00008.pdf
  http://ohioline.osu.edu/b854/b854_1.html
  http://www.fao.org/docrep/t0551e/t0551e03.htm

  The phosphorus content of domestic sewage is approximately 1.5 pounds of phosphorus per year per person. With 103 people using septic systems on the east side of Dudley Pond this means that approximately 155 pounds of phosphorus compounds are discharged into the soil from septic systems abutting the east side of Dudley Pond every year, with the average of 3.16 pounds of phosphorus per septic system discharged each year. The maximum was estimated to be 7.5 pounds of phosphorus per system per year and the minimum was 0 pounds of

phosphorus per septic system per year.

- **What does this mean?** Based on SWQC's 2007 milfoil harvesting costs and a Cornell study [(1)], the phosphorus contained in one person's untreated sewage per year all reached Dudley Pond it would result in approximately 1,900 wet pounds of milfoil and costs the town $267 per year in weed harvesting costs.

- **Septic System Scores** – An arbitrary, unit-less septic system score was calculated for the systems, where the data was available to do so. There was adequate data to score 24 of the 50 septic systems. The scores ranged from 0.06 to 457,634. A low score is good and a high score indicates that the system should be reviewed as do the systems that did not have enough data to be scored.

- **Tight Tanks** – There are two "tight" tanks among the 50 septic systems reviewed. A tight tank is a collection tank that holds the sewage and has to be periodically pumped to remove accumulated sewage. One of these tanks has a volume of 5,000 gallons and the other 4,400 gallons. These two properties used significantly more water between pumping than the tight tanks can hold, which raises the questions, such as
  1) Where did the water go?
  2) Are the tight tanks leaking?

- **Failed System** – The septic system on the Dudley Pond peninsula is located on the adjacent property and has failed. The failure of this system is called a "break out", which involves septage leaking out onto the surface of the ground. The BOH is aware of this situation, which is complicated because the property is a rental property with three inhabitants and is in foreclosure.

Discussion

This section contains a discussion of the results summarized in the previous section.

- **Number of Systems –** 16 of the 50 systems evaluated did not have drawings in the BOH file, which prevented a preliminary SWQC evaluation of these systems. These 16 systems should be required to have a Title 5 inspection to insure that they comply and are not contributing to the nutrient problem in Dudley Pond.

- **Numbers of People** – During this study it was learned that approximately 103 people are contributing sewage containing nutrients to the soil and possibly to the ground water which is flowing into Dudley Pond. This number of people varies during the year primarily because of college attendance.

- **Water Usage** – It is believed that most of the water purchased from the TOW for the properties abutting the east shore of Dudley Pond is used for domestic purposes and seasonal landscape watering. Water use data is gathered approximately twice a year by the TOW DPW and

[1] Effect of Milfoil (*Myriophyllum Spicatum* L.) on Phosphorus Movement Between Sediment and Water,

John H. Peverly and John Brittain, Department of Agronomy, Cornell University, Ithaca, New York

landscape watering is reflected in water usage during the growing seasons. With an average water use per property of 5,400 cubic feet, the properties with much greater water usage than the average are most likely using a significant amount of water for landscape watering. The average water usage on a per person basis is 54 gallons per person per day, which is lower than the USEPA's average per household of 69.3 gallons per capita per day, as shown in Table 2 below.

Fixture/use	Gal/use: Average range	Uses/person/day: Average range	Gal/person/ day: Average range[c]	% Total: Average range
Toilet	3.5 2.9–3.9	5.05 4.5–5.6	18.5 15.7–22.9	26.7 22.6–30.6
Shower	17.2[d] 14.9–18.6	0.75[d] 0.6–0.9	11.6 8.3–15.1	16.8 11.8–20.2
Bath	See shower	See shower	1.2 0.5–1.9	1.7 0.9–2.7
Clothes washer	40.5 —	0.37 0.30–0.42	15.0 12.0–17.1	21.7 17.8–28.0
Dishwasher	10.0 9.3–10.6	0.10 0.06–0.13	1.0 0.6–1.4	1.4 0.9–2.2
Faucets	1.4[e] —	8.1[f] 6.7–9.4	10.9 8.7–12.3	15.7 12.4–18.5
Leaks	NA	NA	9.5 3.4–17.6	13.7 5.3–21.6
Other Domestic	NA	NA	1.6 0.0–6.0	2.3 0.0–8.5
Total	NA	NA	69.3 57.1–83.5	100

[a] Results from AWWARF REUWS at 1,188 homes in 12 metropolitan areas. Homes surveyed were serve by public water supplies, which operate at higher pressures than private water sources. Leakage rates might be lower for homes on private water supplies.
[b] Results are averages over range. Range is the lowest to highest average for 12 metropolitan areas.
[c] Gal/person/day might not equal gal/use multiplied by uses/person/day because of differences in the number of data points used to calculate means.
[d] Includes shower and bath.
[e] Gallons per minute.
[f] Minutes of use per person per day.

Table 2 – Residential Water Use by Fixture or Appliance [2]

The water that is used for domestic purposes results in sewage that carries pollutants and nutrients into septic systems and subsequently into the soil and in some cases into the groundwater. Water that is used for watering landscape during the growing season carrying landscape chemicals that percolate into the soil and may also runoff with rainwater into the Pond. Larger volumes of water used do not necessarily contain more pollutants and nutrients, but higher volumes of water have a tendency to flush nutrients, particularly phosphorus, which is loosely bound to granular soils, into the ground water and subsequently into the Pond. Unfortunately the groundwater on the east shore of the Pond flows into the Pond. So water

[2] *Design Manual: Onsite Wastewater Treatment and Disposal Systems*, EPA/625/R-00/008, pg 3 - 5 February 2002

conservation is important in the Dudley Pond watershed, but very important for the properties in the eastern part of the Dudley Pond watershed. For the above reasons it is recommended that public education and water conservation be actively promoted by the SWQC, DPW, and the DPA in the east Dudley Pond watershed.

- **Types of Systems** – A schematic of a Leach Pit (Cesspool) is shown in Figure 4 and a schematic of a Septic Tank with a leach field is shown in Figure 5.

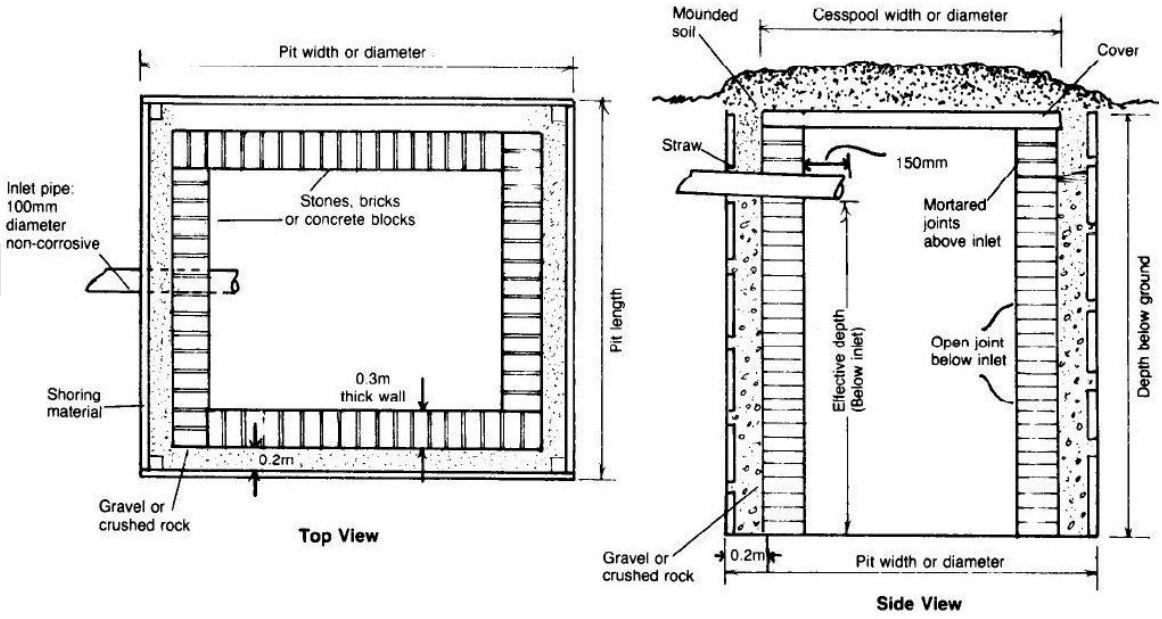


Figure 4 - Leach Pit (Cesspool)

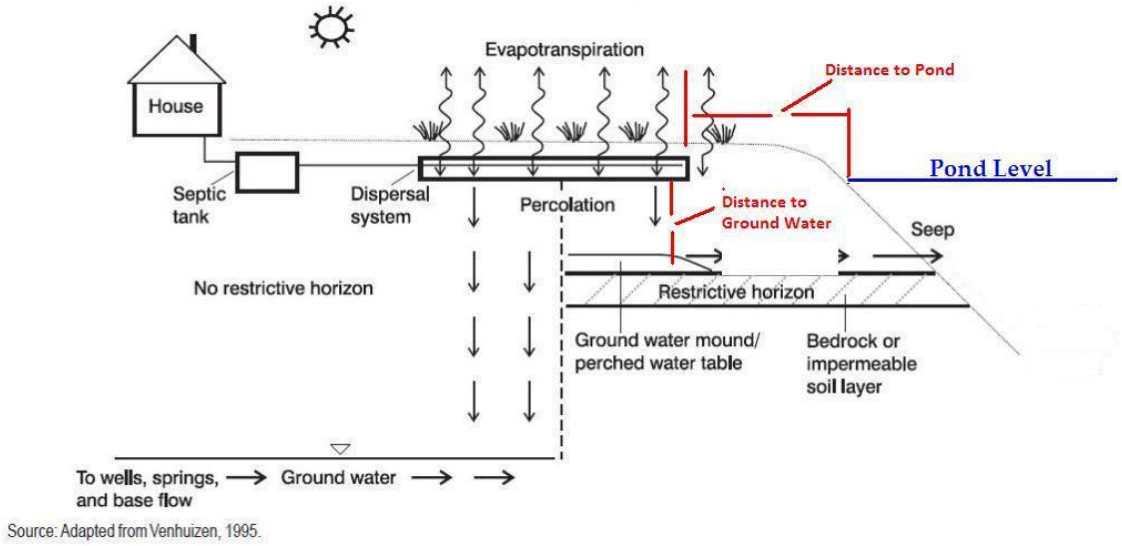


Figure 5 - System Proximity to Pond [3]

[3] Ibid, pg 1 - 7

- **Septic System Age** – The functioning of conventional septic systems depends on the adsorptive capacity of the soil to remove phosphorus and other contaminants from sewage. Since the adsorptive capacity of a septic system for phosphorus is finite, the useful life of a septic system is finite, unless technology is installed to remove phosphorus compounds from the septic system effluent before it is discharged to the soil. With a very high density of septic systems east of Dudley Pond, many of which are old (avg. age 24 years old), there is concern that the phosphorus in the sewage being discharged into the east part of the Dudley Pond watershed is not being adequately removed to protect the health of Dudley Pond. This problem is compounded where groundwater flows into the Pond as it does on the east side of Dudley Pond.

- **Title 5** – A Title 5 inspection form can be found at the following site. http://www.mass.gov/dep/water/approvals/t5forms.htm#inspect Many communities that have water bodies that are suffering from nutrient overloading are passing by-laws requiring Title 5 inspections within a given period of time so that failing septic systems can be remediated. Since Dudley Pond has been identified as Category 5 impaired water bodies, it is recommended that Wayland adopt watershed by-laws that mandate a timetable for Title 5 inspections. To view such a community watershed by-law visit: http://google.whatifnet.com/search?q=Regulation+64&btnG=Search&entqr=0&output=xml_no_dtd&sort=date%3AD%3AL%3Ad1&client=nantucketma&ud=1&oe=UTF-8&ie=UTF-8&proxystylesheet=nantucketma&site=nantucketma

- **Proximity to Ground Water** – Most of the removal of pollutants from septic system effluent occurs in the non-saturated zone (above the water table) of the soil. Having the bottom elevation of the leach area very close to the ground water elevation is not good because contamination of ground water becomes more likely. The septic systems located on Knollwood Lane and Dudley Rd., because of being located at higher elevations, have a large number of feet vertically separating the bottoms of leach areas and the groundwater table. Ideally it is best to have as much separation between the bottom elevation of leaching area and the groundwater elevation to facilitate removal of pollutants, particularly in cases where the ground water is flowing into the Pond. (ref. Figure 5 above) Many communities require a minimum separation five feet or more between the bottom elevation of the leach area and groundwater elevation in watersheds of impaired water bodies. http://google.whatifnet.com/search?q=Regulation+64&btnG=Search&entqr=0&output=xml_no_dtd&sort=date%3AD%3AL%3Ad1&client=nantucketma&ud=1&oe=UTF-8&ie=UTF-8&proxystylesheet=nantucketma&site=nantucketma

  It is recommended that Wayland adopt watershed by-laws that mandate a minimum separation of the leach area and the groundwater table in watersheds around Dudley Pond, Heard Pond and North Pond of Lake Cochituate. Since the elevation of water table on the east side of Dudley Pond is greater than the elevation of the Pond it is a reasonable assumption that ground water on the east side of the Pond is flowing into the Pond. The 1983 IEP report measured the elevation of the water table around the perimeter of Dudley Pond and also concluded that the ground water was flowing into the Pond on the east side. This finding raises a number of issues, such as:
  1) What is the ground water profile farther to the east of the Pond? and
  2) Is the soil associated with the ground water on the east side of the Pond saturated with phosphorus compounds, resulting in the nutrients from many of the properties east of Dudley

Pond entering the Pond via ground water?

Ground water elevations between the Pond and Route 27 should be investigated as well as the phosphorus content of the ground water at various locations in this area.

- **Percolation Rates** – The percolation rate or percolation rate is a measure of how readily water moves through soil and is measured by the number minutes that it takes the water level in a test hole to decrease one inch. Low percolation rates (minutes per inch) are associated with granular soils such as sand. High percolation rates are associated with soils that have clay and/or organic materials present that inhibit the movement of water. From a hydraulic point of view having a low percolation rate is good; however, most sandy soils with low percolation rates have limited sites that adsorb and hold nutrients such as phosphorus compounds. Unfortunately, from a nutrient retention point of view, most of the soils around Dudley Pond have low percolation rates and do not have a high capacity adsorb and retain large amounts of phosphorus compounds.

- **Distance to the Pond** – Having a long horizontal distance (ref. Figure 5) between septic systems and the Pond above the water table is ideal to maximize the treatment of pollutants and to remove phosphorus compounds contained in domestic sewage. However, some of the properties along Crest Rd, Pond Rd. and Lakeview are so small that it is difficult to locate a septic system more than forty or fifty feet from the Pond. One of the owners of the property on Pond Rd solved this problem by locating their septic tank on TOW property approximately 270 feet to the east of the Pond. Others solved this problem by installing a tight tank. The septic systems that are close to the Pond merit further review such as a Title 5 inspection, to insure that they are not sources of nutrients contaminating Dudley Pond.

- **Year Pumped** – Septic systems require pumping to remove accumulated solids so that the solids do not flow into the leaching area and reduce the permeability of the soil causing hydraulic failure. When septic systems are pumped the company that pumps the septic system is required to submit a record of pumping ("ticket") to the BOH containing the owner's/renter's name, date, volume of septage pumped, where the septage was discharged as well as a cursory inspection of the system. The BOH stated that filing of septage pumping "tickets" occurs within 6 months of when the BOH receives them. By not pumping septic tanks frequently enough the nutrients contained in the sludge will be solubilized and pass out of the septic tank and into the leach field along with solids. Communities that have water bodies that are overloaded with nutrients are passing by-laws that require septic systems that are within the watershed to be pumped every two to three years. It is recommended that Wayland consider a by-law with such a requirement, particularly within the watersheds of Dudley Pond, Heard Pond and North Pond of Lake Cochituate.

- **Phosphorus Pollution** – According to the USEPA the distribution of sources of phosphorus within a household are shown in Table 3 below.

Parameter		Garbage disposal (gpcd)[c]	Toilet (gpcd)[c]	Bathing, sinks, appliances (gpcd)[c]	Approximate total (gpcd)[c]
BOD_5	mean	18.0	16.7	28.5	63.2
	range	10.9–30.9	6.9–23.6	24.5–38.8	
	% of total	(28%)	(26%)	(45%)	(100%)
Total suspended solids	mean	26.5	27.0	17.2	70.7
	range	15.8–43.6	12.5–36.5	10.8–22.6	
	% of total	(37%)	(38%)	(24%)	(100%)
Total nitrogen	mean	0.6	8.7	1.9	11.2
	range	0.2–0.9	4.1–16.8	1.1–2.0	
	% of total	(5%)	(78%)	(17%)	(100%)
Total phosphorus[d]	mean	0.1	1.6	1.0	2.7
	range	—	—	—	—
	% of total	(4%)	(59%)	(37%)	(100%)

[a] Adapted from USEPA, 1992.
[b] Means and ranges for BOD, TSS, and TN are results reported in Bennett and Linstedt, 1975; Laak, 1975;Ligman et al., 1974; Olsson et al., 1968; and Siegrist et al., 1976.
[c] Grams per capita (person) per day.
[d] The use of low-phosphate detergents in recent years has lowered the TP concentrations since early literature studies; therefore, Sedlak (1991) was used for TP data.

Table 3 - Residential Wastewater Contribution by Source [(4)]

A pond or lake with a phosphorus (total phosphorus) concentration of greater than 25 – 30 ppb is considered eutropic (over fertilized) according on the Carlson Tropic State Index. Historically the total phosphorus concentration in Dudley Pond has been in the range of 20 – 50 ppb. If a year's worth of sewage from one person were dumped into Dudley Pond the result would be an increase of approximately 0.7 ppb phosphorus concentration in the Pond. Because the discharge from Dudley Pond is intermittent, most of the phosphorus that enters the Pond stays in the Pond and is converted to biomass (algae and/or weeds), which die seasonally, decompose and the phosphorus from the decomposing biomass is reincorporated into biomass during subsequent growing seasons. As a result a small number of failed septic systems can result an unacceptable accumulation of phosphorus over time; which is the case for Dudley Pond.

- **TMDL** – In order to propose watershed nutrient by-laws for Dudley Pond a defensible basis is needed. A Total Maximum Daily Load (TMDL) study, which is mandated by the State for Category 5 impaired waters, will provide that basis. In 2009 SWQC applied for a State grant to fund a phosphorus TMDL study. This grant application was not funded; however, the SWQC will continue to seek funding to complete a Dudley Pond TMDL for phosphorus as mandated by the State.

- **Septic System Scores** – Septic systems found to have relatively high scores merit further review to determine why the score is high and what can be done about lowering the score. As information regarding properties that were found to be missing is determined, septic systems scores should be calculated and reviewed.

- **Tight Tanks –** One of the properties is serviced by a 4,400 gallon tight tank and has one person using the system. The last pumping record in the BOH file for this property was November 2009 (a year ago). The average water usage at this address for the last two years was 2,150 cubic feet per year (16,082 gallons per year). It appears a year has passed since the last pumping and approximately 16,000 gallons of water have been used with a 4,400 gallon tank to collect the sewage. This situation merits review to insure that sewage is not leaking from the "tight" tank.

[4] Ibid, pg 3 - 11

Another property has a 5,000 gallon "tight" tank. Over the past two years this property used on average 9,100 cubic feet of water per year (68,068 gallons per year) and the last record of pumping of the tight tank was 2008. This system should also be reviewed to insure that it is not leaking.

Failed Systems – With three people renting a house located Dudley Pond peninsula with a failed septic system could potentially be contributing 4.5 pounds per year of phosphorus into the Pond, resulting in an increase of the Pond total phosphorus concentration of 2.1 ppb. Based on USEPA data 25% of septic systems in Massachusetts have failed. [5] If this is the case it is expected that there are probably other Dudley Pond septic systems within the 50 systems reviewed that have failed. Since the BOH is aware of the septic system failure and the incorrect location for this property, it has been assumed that the BOH will deal with this situation based on the applicable laws that are currently in place. This property is located near the southern tip of the peninsula in Dudley Pond and is very close to Sample Point C, which was part of the Pond circulator performance evaluation program. The water quality parameters associated with Sample Point C gathered during 2007, and 2008 were often very different than the other sample points as can be seen in Table 4 below.

Table 4 - Summary of Unusual Water Chemistry at Sample Point C

Occurrence	Depth	Date
Season's High Temperature	1'	8/27/08
Season's High Temperature	1'	7/10/07
Season's Highest % Dissolved Oxygen	9'	4/25/08
Season's Highest & Lowest pH	1' & Bottom	9/15/07
Season's Highest Total Phosphorus	6'	4/25/08
Season's Highest Total Phosphorus	1'	11/18/07
Lowest November Secchi Disc Depth	3+ m	11/18/08
Season's Lowest ORP	Bottom	7/10/08

*This table was taken from the 2008 Dudley Pond Circulator Evaluation Report prepared by the SWQC.

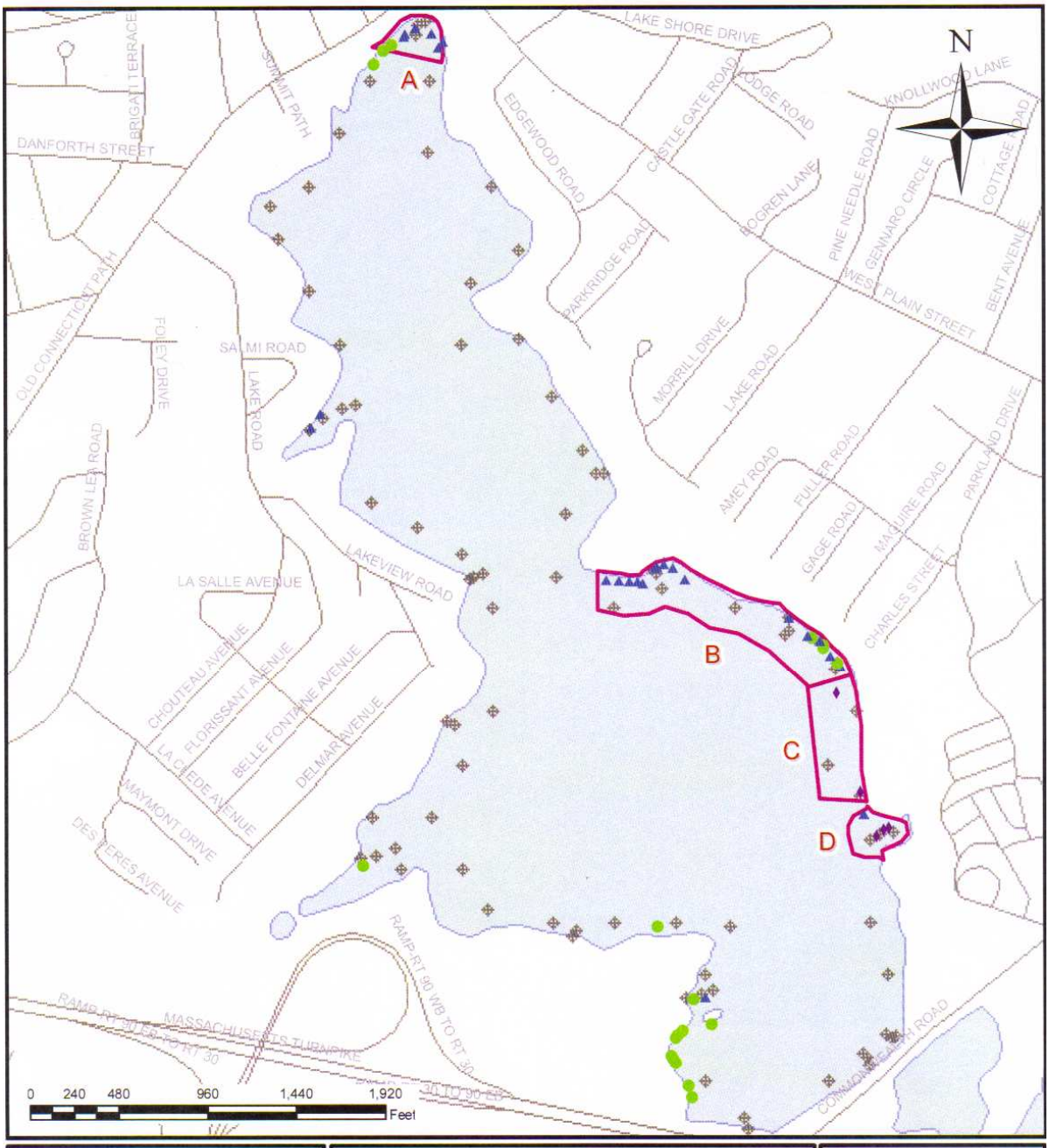
It is not clear whether the failed septic system influenced the water chemistry data taken at Sample Point C during the 2007 and 2008 seasons.

[5] Ibid, pg 1 - 7

Appendix

The spread sheet containing the data gathered during this study can be obtained from Steve Calichman, TOW BOH.

Attachment 6
DCR Contractor (ACT) Milfoil Survey in North Pond at end of September 2010



Lake Cochituate
North Pond
Wayland, Natick, Framingham

Eurasian Watermilfoil Distribution

FIGURE:	SURVEY DATE:	MAP DATE:
4	9/27/10	1/11/11

Legend:

North Pond Survey Points
Estimated EWM stem density during 9/27/10 survey
- Single plant or stem
- 2-5 plants or stems
- 6-20 plants or stems

LABEL	ACREAGE
A	1.4
B	7.6
D	1.4
C	3.8

AQUATIC CONTROL TECHNOLOGY, INC.
11 JOHN ROAD
SUTTON, MASSACHUSETTS 01590
PHONE: (508) 865-1000
FAX: (508) 865-1220
WEB: WWW.AQUATICCONTROLTECH.COM

Attachment 7

Milfoil Fragments Collection at Entrance to North Pond (Lin Bradford)

Date 2011	Time	Temp Air	Temp Water	Weather	Quantity Gals	Misc.	Collected By
7-May	9:00 AM	62	60.3	Sunny Light Wind	0	Attached Groins	L. Bradford
11-May	3:00 PM	66	60	Partly Cloudy	30	90% Milfoil	L. Bradford
13-May	2:00 PM	73	64	Sunny light SW Wind	10	90% Milfold + 1 Flip Flop	L. Bradford
19-May	2:00 pm	66	58.6	Overcast rainy	25	90% Milfoil	L. Bradford
21-May	11:30 AM	73	64.4	Sunny Light Wind	50	80% + 1 Painted Turtle	Mike & Lin