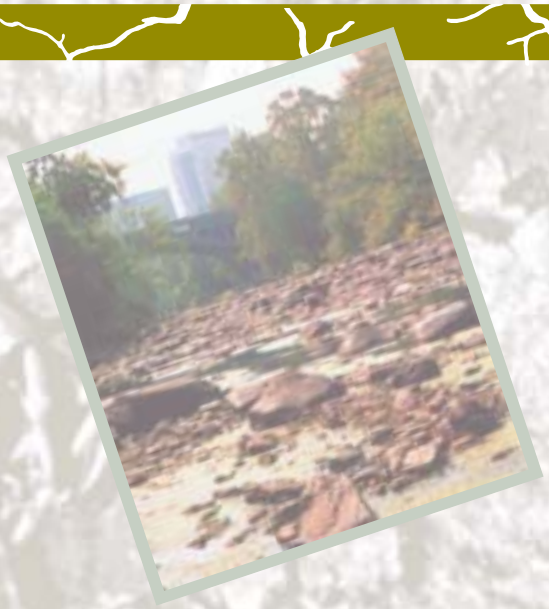
Proceedings of
University of Delaware

DROUGHT.02

A Debate and Panel Discussion Concerning Water Supply Policy in Delaware

held Wednesday, October 9, 2002, on the University of Delaware's Newark campus



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Institute for Public Administration
College of Human Services, Education & Public Policy
University of Delaware

In cooperation with:
Delaware Department of Natural Resources & Environmental Control and the
Delaware Water Resources Center, University of Delaware

February 13, 2003

Dear Colleague:

We are pleased to present the proceedings of the Delaware Policy Forum titled ***Drought.02: A Debate and Panel Discussion Concerning Water Supply Policy in Delaware*** held on Wednesday October 9, 2002 at Clayton Hall on the University of Delaware campus in Newark, Delaware. The University of Delaware, Institute for Public Administration cosponsored this event with the Delaware Department of Natural Resources and Environmental Control and the University of Delaware Water Resources Center.

In the midst of the record drought of 2002, invited panelists from government, private sector, and academia were asked to debate the pros and cons of issues concerning drinking water policy in Delaware. The panelists were asked to address the following question: *In the wake of multi-year droughts in Delaware, what should be done to ensure the delivery of clean and plentiful drinking water to Delaware residents and businesses?* Several speakers advocated a supply-side approach such as expanding existing reservoir capacity or building desalination plants. On the demand side, several speakers recommended water conservation practices through pricing controls.

Over 150 attendees at the ***Drought.02*** policy forum were able to react to the proceeding policy debate, ask a series of interactive questions, and participate in a survey concerning the future of water policy in Delaware. One of the interesting results of the water policy survey indicated that the most highly rated water supply projects were to: (1) expand Hoopes Reservoir, (2) recycle wastewater, and (3) store water in underground reservoirs (aquifer storage and recovery). The lowest rated water supply option by the participants in ***Drought.02*** was … do nothing.

We would like to thank the speakers and attendees that committed their time to participate in this event. Special thanks are offered to the water policy forum organizing committee namely: Bernard Dworsky, Ruth Fallis, Christine Godek, Arthur Jenkins, Gerald Kauffman, Stacy Lapasnick, Jerome Lewis, Frank Mieczkowski, Kevin Vonck, Martin Wollaston and Sara Wozniak.

We hope these proceedings can be used to help shape water supply policy in Delaware and that you'll consider joining us for future discussions regarding water – our most precious natural resource.

Regards;

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Gerald J. Kauffman, State Water Coordinator
University of Delaware
Institute for Public Administration
Water Resources Agency

Agenda

8:30 – 9:00	Registration and Continental Breakfast
9:00 – 9:15	Welcome to the Delaware Policy Forum Series *Dr. Jerome Lewis, Director, UD Institute for Public Administration*
9:15 – 9:30	Delaware Water Supply Policy *Kevin Donnelly, Director, Delaware DNREC Division of Water Resources*
9:30 – 10:00	The Anatomy of a Drought .02 *Gerald Kauffman PE, State Water Coordinator, UD Institute for Public Administration, Water Resources Agency*
10:05 – 10:15	BREAK – POSTER / EXHIBIT SESSION
10:15 – 11:15	Debate and Panel Discussion *Moderator: Kevin Donnelly, Director, DNREC Division of Water Resources* In debate format, invited panelists were asked to discuss the pros and cons of issues concerning drinking water policy in Delaware. The panelists were asked to explore the following question: In the wake of multi-year droughts in Delaware, what should be done to ensure the delivery of clean and plentiful drinking water to Delaware residents and businesses? The panelists included: ▪ Preston Leutweiler, Vice President *Philadelphia Suburban Water Company* ▪ Dr. Irving Moch, President *Moch & Associates (Desalination)* ▪ Joseph Dombrowski, Director *City of Newark, Water and Wastewater Department* ▪ Dr. Paul Solano, Professor of Urban Policy *University of Delaware, School of Urban Affairs & Public Policy* ▪ Jamie Jamison, President *Brandywine Nurseries, Inc* ▪ Debra Heaton, Delaware Director *The Sierra Club* ▪ Jeff Bross, President *Duffield Associates, Engineers and Geologists* ▪ Kevin Vonck, President *University of Delaware, Urban Affairs Student Association* ▪ Ed Hallock, Program Administrator *Delaware Division of Public Health, Office of Drinking Water*

11:15 – 12:00	Interactive Audience Discussion *Moderator: Bill McGowan, Educator, University of Delaware, Institute for Public Administration and Sussex County Extension Educator* During this session, attendees were asked to react to the proceeding policy debate and answer a series of interactive questions concerning the future of water policy in Delaware.
12:00 – 1:30	LUNCH / POSTER SESSION
1:30	ADJOURN

Invited panelists from left to right: Ed Hallock, Joe Dombrowski, Jamie Jamison, Debbie Heaton, Jeff Bross, Dr. Irving Moch, Dr. Paul Solano, Kevin Vonck, Preston Leutweiler, and moderator Kevin Donnelly

Drought .02: A Debate and Panel Discussion Concerning Water Supply Policy in Delaware
University of Delaware, Clayton Hall
October 9, 2002

Introductory Session

Welcome to the Delaware Policy Forum Series
Dr. Jerome Lewis, Director, University of Delaware, Institute for Public Administration

Abstract: Dr. Lewis welcomed over 130 attendees to the Delaware Policy Forum addressing water supply policy. He thanked the Department of Natural Resources and Environmental Control (DNREC) and Delaware Water Resources Center for their co-sponsorship with the Institute for Public Administration (IPA) - Water Resources Agency (WRA) on this important forum and reminded everyone that this is only one in a series of policy forums sponsored throughout the year. Dr. Lewis expressed his gratitude for the success of last year's drinking water forum and hoped that by using feedback from this year's forum there would be in an increase in participation for future events.

Biography: Dr. Lewis is the first Director of the University of Delaware, Institute for Public Administration. Jerome is a member of the faculty in the School of Urban Affairs and Public Policy and teaches graduate courses in public administration and public policy. The UD Institute for Public Administration links the research and resources of the University of Delaware with the management, information, and leadership needs of schools and local, state, and regional governments in the Delaware Valley. IPA provides assistance to agencies and local governments through direct staff assistance and research projects as well as training programs and policy forums.

Delaware Water Supply Policy
Kevin Donnelly, Director, DNREC, Division of Water Resources

Abstract: Mr. Donnelly began by stressing the need to use the forum as a step towards determining what water supply outcome the state wants for the future. He assured the audience that Governor Ruth Ann Minner is committed to the water supply issue through her efforts with the Water Supply Coordinating Council and Senior Cabinet Team. With projects such as additional storage from Hoopes Reservoir, Newark Reservoir construction, and Artesian Water Company's groundwater projects, Kevin pointed out that Delaware is more than 70% finished achieving the increased water supply needed following the drought of 1999. However, further steps need to be taken to ensure adequate water supply for Delaware in the future including increased coordination between the agencies involved in water supply, controlling demand through the use of pricing techniques and monitoring of downstate water conditions. In conclusion, Mr. Donnelly stated that the Water Supply Coordinating Council would use the lessons learned in the past, during the droughts of 1999 and 2002, to implement additional water supply alternatives for the future.

Biography: Since September 1999, Mr. Donnelly has served as Director of DNREC's Division of Water Resources where he oversees the second largest Division in DNREC with responsibilities for wastewater infrastructure planning and financing, the state's environmental laboratory, water supply and allocation, programs addressing the discharges into the state's surface and ground waters, wetlands and subaqueous lands, and water quality monitoring and assessment including the development and implementation of total daily maximum load program. As Director, he represents the state on the

Delaware River Basin Commission, several national estuary programs, the Association of State and Interstate Water Pollution Control Agencies, and various EPA working committees. Prior to becoming Director he served eight years as the Environmental Program Administrator for District Operations in DNREC's Division of Soil and Water Conservation. Mr. Donnelly also worked for the Delaware Department of Agriculture as a planner in the Aglands Preservation Section and forester with the State Forest Service.

The Anatomy of a Drought .02

Gerald Kauffman, State Water Coordinator, University of Delaware, Institute for Public Administration, Water Resources Agency

Abstract: The drought of 2002 is perhaps the latest chapter in a multiyear dry period that began during the droughts of 1995 and 1999. Based on Brandywine Creek streamflows and precipitation records that date back almost a century, the drought of 2002 was the 100-year-drought. Since 1999, the water purveyors on the Delaware Water Supply Coordinating Council are on schedule to implement over 1 billion gallons in additional water supply projects from the Newark Reservoir, Newark South Wellfield Treatment Plant, Hoopes Reservoir Deep Storage Project and Artesian Water Company new wells and Aquifer Storage and Recovery projects. However, WSCC estimates that an additional 400 mg should be developed to meet drought of record needs based on peak demands forecast for 2020. Additional projects that will be debated to meet this need include raising Hoopes Reservoir, wastewater reuse, desalination, and others. Streamflow records along the Brandywine Creek indicate that multiyear droughts are often followed by a string of wet years. Preliminary research data suggests that the record low streamflows experienced last summer are due to a combination of an abnormally long sequence of dry months and a 200% population increase since the 1960's in the Brandywine Creek watershed.

Biography: Gerald Kauffman is the State Water Coordinator/Water Resources Engineer with the Water Resources Agency in the Institute for Public Administration, College of Human Services, Education, and Public Policy at the University of Delaware. Mr. Kauffman is responsible for providing water resources technical and policy assistance to state and local governments and the public in Delaware and the Delaware Valley through the University's public service, education, and research role. Gerald graduated from the Rutgers University College of Civil and Environmental Engineering and is a Master of Public Administration candidate at the University of Delaware. He has been a registered professional engineer in four states. Jerry teaches courses in Regional Watershed Management and Water Resources Engineering as part of the educational role at the University of Delaware. His research interests include watershed management, policy and governance.

Debate and Panel Discussion

Moderator: Kevin Donnelly, Director, DNREC, Division of Water Resources

Preston Leutweiler, Vice President
Philadelphia Suburban Water Company

Abstract: From the prospective of an upstream neighbor, Mr. Leutweiler began by urging Delaware to keep doing what it is doing without becoming reliant on other states. Preston suggested three ways to continue increasing water supply. First, promote increased storage like Hoopes Reservoir expansion and construction of the Newark Reservior. Second, promote interconnections to increase reliability and supply, possibly with the City of Philadelphia. Lastly, pricing controls are needed to reflect the scarcity of water as well as investment in infrastructure is needed to provide an incentive to drought-proof the state.

Biography:

Dr. Irving Moch, President
Moch & Associates (Desalination)

Abstract: Dr. Moch stressed the economics of using desalinization as a method to increase water supply because of its worldwide appeal as a multi-million dollar industry. The market for membrane technology has increased 12% per year. Discussing an economic study, Dr. Moch provided the following estimated construction and operating costs for a 20 mgd reverse osmosis plant:

	Total Cost	Cost/ Day
Construction Costs	$42.0 M	$2.12 (per gallon)
Operating Costs	$ 3.4 M	$1.56 (per 1000 gal.)

In conclusion, he believes that the world is moving towards membrane technology and so should Delaware.

Biography: Dr. Irving Moch, Jr. received his undergraduate and graduate Chemical Engineering and undergraduate Liberal Arts degrees from Columbia University, New York City and has been associated with water treatment for over 24 years. He has founded his own consulting organization specializing in all facets of water treatment including design, operations, projects and troubleshooting, providing both on-site plant visits and teaching seminars. Before consulting, Dr. Moch spent over forty years with the DuPont Company in various capacities in Marketing, Manufacturing, Engineering and Research and Development.

Dr. Moch is a Director and past Editor of the International Desalination Association (IDA) and Director Emeritus and former International Liaison Committee chair of the American Membrane Technology Association (AMTA). He is also a member of the American Water Works Association's (AWWA) Water Desalting Committee. As chairman of the American Society for Testing and Materials (ASTM) D19 task group on ultrafiltration, microfiltration, nanofiltration and reverse osmosis, he is leading the effort for writing standards for United States industry. He is also involved in

the health effects protocol presently being adopted within the United States as a member of the Joint Committee, Water Additives-Health Effects NSF International, Standards 60 and 61 under the auspices of the Environmental Protection Agency (EPA) and American National Standards Institute (ANSI). Together with the US Bureau of Reclamation, he has developed a CD ROM water treatment cost model that is currently being employed as a standard for estimating plant capital and operating costs A holder of patents, Dr. Moch has published extensively throughout the world in the field of water resources and is on the editorial board of the International Desalination and Water Reuse Quarterly.

A recognized expert in water treatment, Dr. Moch has been elected to the AMTA Hall of Fame and is listed in Who's Who in Science and Engineering, Who's Who in Finance and Industry, Who's Who in the East and American Men & Women of Science. In addition, he has been elected to membership in Phi Lambda Upsilon and Sigma XI, honorary chemical and research societies respectively. He also holds membership in the American Institute of Chemical Engineers (AIChE), American Chemical Society and the American Association for the Advancement of Science. Currently, Dr. Moch is registered with the AIChE as a consultant and expert witness.

Joseph Dombrowski, Director
City of Newark, Water and Wastewater Department

Abstract: Mr. Dombrowski began by discussing the missed opportunities for increased water supply in Delaware that have caused our current reliability on many small projects. Newark has taken charge of the water supply issue by constructing a south wellfield iron treatment plant and a new reservoir. With concern towards the rest of the state, Wilmington could increase the size of Hoopes Reservoir, Artesian Water could increase aquifer storage and recovery, a connection under the C and D Canal could be a good idea if groundwater studies are approved, and the United Water Tidal Capture Structure could be maintained. On the other hand, he also disapproved of several options such as Bread and Cheese Island Reservoir, Thompson Station Reservoir, Philadelphia to Delaware pipeline and desalinization.

Biography: Joe is a native Delawarean who graduated from the University of Delaware in 1973 with a bachelor's degree in Civil Engineering and in 1979 with a master's in Civil Engineering with an emphasis on water supply engineering. His thesis was on Aquifer Storage and Recovery for Newark's Well 17. From 1973 to 1978, his career was in the New Castle County Water Management Office (later to become the Water Resources Agency) working with Merna Hurd and Bernie Dworsky. In 1978 his career started with the City of Newark Water Department and he has been the Director for 20 years.

Dr. Paul Solano, Professor of Urban Policy
University of Delaware, School of Urban Affairs & Public Policy

Abstract: Dr. Solano stressed the need to change from a water supply focus to one of water demand to get around the problems associated with infrastructure growth. Water demand changes should be structured in both short and long term projects. In the short-run, methods such as the implementation of an inclining block rate with inflation adjusted prices and seasonal (peak load) pricing were discussed. Also, more frequent water billing to users, information dissemination with publicized rates, and subsidies for water conservation including vouchers for consumers for technology should be used.

In the long-run, future demand needs to be controlled using marginal cost charging for new water connections and new water supplies need to be balanced with demand control.

Biography:

Jamie Jamison, President
Brandywine Nurseries, Inc

Abstract: Mr. Jamison began by pointing to missed opportunities and being too fast and loose with the water supply as reasons for our current water situation. While the landscape industry is one of the most conservative when it comes to water use, the consumers are the ones who have perpetuated the wasting of water supplies. Thus, education of consumers is needed to solve the water supply problems and not just municipalities but also private water utilities. There will never be a large regional reservoir so many small projects need to be embraced to increase supply. For example, water reuse (like that of Disney World) is of paramount importance for the future.

Biography: Jamie Jamison is the President of the Environmental and Site Division of Brandywine Nurseries. The company is over 50 years old and located in Wilmington Delaware. The Environmental and Site division performs a variety of operations including athletic field design and installation, wetland and riparian restoration, sediment and erosion control, EPA Superfund Site mitigation, stormwater pond maintenance and restoration and water quality management.

Jamie's educational background includes advanced graduate degrees in turf and soil sciences and environmental sciences from the University of Dallas and Rutgers University Cook College. He recently was awarded a degree in business administration from Wesley College.

Locally, he has served as President of the Delaware Nursery and Landscape Association and is the current President of the First State Branch of the Professional Grounds Management Society. He also serves on several advisory councils, including the New Castle County and Delaware Agricultural Extension Advisory Councils, the New Castle County Vocational Technical School District and that district's Horticultural Program Committee, the Delaware Water Supply Coordinating Council and advises the Governors Drought Advisory Committee on the concerns and position of the Green Industry in our state.

Nationally he serves on the Board of Governors, the Water Management and Horticultural Standards Committees of the American Nursery and Landscape Association and was President of the National Landscape Association.

Debra Heaton, Delaware Director
The Sierra Club

Abstract: Mrs. Heaton began by mentioning that the water issues faced by Delaware are not just weather related but also are caused by increased population and the effects of that. For example, since the 1960s, the population has increased 75%. In order to maintain a lasting change within the water supply of Delaware, land use and water resources need to be connected. Some of her goals for increased water supply include separating drinking water from other uses, researching more about groundwater and aquifer supplies, inventory wells permitted, and locate and protect water recharge

areas statewide. Debra also discussed goals for increasing water quality such as researching aquifers affected by industries, mapping salt water movement, identifying point source pollution and improving treatment of antibiotics and hormones found in water. From a regulatory standpoint, she believes that water should not be allowed to be taken from Delaware's streams by fighting flow bypasses, enforcing laws, setting conservation water rates, researching current TMDL levels, using numeric water quality data and challenging government agencies to work with industry to solve water problems.

Biography: Debbie, a volunteer with the Delaware Chapter of the Sierra Club, currently serves as Chapter Conservation Chair. She has been helping with Sierra Club efforts to protect Delaware's waters and improve water quality through Total Maximum Daily Loads, National Pollution Discharge Elimination System and Subaqueous Lands permit processes and Coastal Zone work over the last eight years. She is also active with the Sierra Club outside the state serving on several national committees and is currently Green Watch Institute president. When she is not on Sierra Club work Debbie is a small business owner focussing on communication design in the Middletown area.

Jeff Bross, President
Duffield Associates, Engineers and Geologists

Abstract: Mr. Bross emphasized the fact that there is not one single solution to the multi-faceted problem of water supply in Delaware. The economic impacts of an inadequate water supply can also be seen in the difficulties of gaining and retaining businesses in Delaware. One solution to this could be to set rates but caution needs to be taken when deciding on a price so Delaware does not lose residents to other states with lower rates.

Due to the fact that New Castle County is reliant on surface water, Jeff believes increased storage is a must. This includes another reservoir, increase in Hoopes Reservoir if flow restrictions are looked into, increased aquifer storage, and more interconnections possibly between northern and southern Delaware. According to Mr. Bross, one option that should be disregarded is desalinization. Another aspect of the water supply issue that should be regarded is water security. If problems arise with one option such as surface water, we want to have back up options like groundwater. Finally, after the Water Supply Coordinating Council finishes developing water supply options, the market should take over.

Biography: As President of Duffield Associates, Inc., a geoscience consulting firm, Mr. Bross has administrative, consulting, and project management responsibility for coastal engineering, water resources, environmental, solid and hazardous waste, and regulatory agency projects. He has authored numerous technical articles and papers, and is a featured national speaker on issues involving environmental and construction matters. Mr. Bross is a Registered Professional Engineer in Delaware, Maryland, New Jersey, Pennsylvania and Nebraska. He is the Past-Chairman of the Board of Directors for the New Castle County Chamber of Commerce and currently serves as Co-Chairman of the New Castle County Economic Development Council. He serves on the Boards of Directors of the Committee of 100 and the Associated General Contractors of Delaware as well as being National Chair of the American Council of Engineering Companies and Associated General Contractor's Construction Liaison Committee. He is an appointed member of the State of Delaware Workforce Investment Board, the New Castle County Executive's Task Force on Redevelopment, and the Livable Delaware, Infill and Redevelopment Subcommittee. He is an instructor for the Department of Civil and Environmental Engineering at the University of Delaware.

Kevin Vonck, President
University of Delaware, Urban Affairs Student Association

Abstract: Mr. Vonck began by stressing the need for both supply and demand options to help solve the water problems of Delaware. Kevin focused on the following demand side changes because he believes that there is a lack of exploring this aspect of water resources.

- Funding should be provided to help homeowners purchase rain barrels.
- Zoning ordinances should be changed to allow residents to use rain barrels and native landscaping.
- Monthly history charts of water consumption in gallons should be distributed to citizens like regular utility bills.
- Landlords should be encouraged to remove water charges from all-inclusive bills.
- The WSCC should be renamed the Water Supply and Demand Coordinating Council.

Biography: Mr. Vonck is a graduate student in the Master of Public Administration program in the School of Urban Affairs and Public Policy at the University of Delaware. Kevin graduated from the University of Wisconsin - Madison majoring in Geography and History. He is the recipient of a graduate research assistantship in water resources. Mr. Vonck is President of the UD Urban Affairs Student Association and was appointed by Newark City Council to represent Councilmanic District 6 as a member of the Newark Conservation Advisory Commission (CAC).

Ed Hallock, Program Administrator
Delaware Division of Public Health, Office of Drinking Water

Abstract: Mr. Hallock focused on desalinization as the best long-term solution to a water supply option because it is cheaper, already used throughout the world and would provide a never-ending supply. Other alternates suggested were increasing groundwater supplies. Ed believed that pipelines to Philadelphia and large reservoirs should be avoided.

Biography:

- A life-long resident of Delaware, Ed graduated from Lake Forest High School in Felton in 1975.
- Received a Bachelors Degree in Biology from the University of Delaware in 1980.
- Worked in the Division of Public Health for 18 years.
- Began public health career in the Division of Public Health, Office of Food Protection in 1983.
- In 1986, accepted the job in the Office of Sanitary Engineering, drinking water program.
- Program Manager for the Office of Drinking Water in 1991 and Program Administrator in 1999.
- Participated on the National Drinking Water Advisory Committee workgroup that developed the Consumer Confidence Report Rule and represented Delaware on an EPA/State workgroup revising the Public Notification Requirements of the Safe Drinking Water Act.
- Active member of the Chesapeake Section, American Water Works Association where I am a Trustee and the Association of State Drinking Water Administrators where I am the Chairman of the Consumer Awareness Ad Hoc Committee. I am also a past Treasurer of the Delaware Public Health Association

Interactive Audience Discussion

Moderator: Bill McGowan, Educator, University of Delaware, Institute for Public Administration and Sussex County Extension Educator

Mr. McGowan opened the floor to the audience for questions:

Question: Can we afford to flush toilets with potable water?

Answer: Mr. Leutweiler - Maybe for new towns a two pipe system would be feasible but not for existing systems because of the cost of infrastructure.

Question: What is the justification for keeping the Hoopes Reservoir so full at the detriment to landscaping industries?

Answer: Mr. Dombrowski - In midst of historic droughts, we need to keep reservoirs filled because we don't know how long drought will last. Also, there is no certainty when it comes to rainfall patterns and we need to maintain some control and relief to everyone in drought conditions.

Answer: Mr. Jamison - Hoopes Reservoir should not be used to water lawns. The landscaping industry has been working with the government to develop water conservation techniques, which has provided some respite.

Question: Does the Sierra Club support water conservation pricing?

Answer: Ms. Heaton - Yes it should play a role, but we are also looking beyond that in land use planning to solve our problems.

Question: If we don't look into the future impact of land use and sprawl, could this lead to a worse crisis?

Answer: Mr. Bross - New Castle County has a Unified Development Code that controls development and requires water friendly subdivisions. The state and other municipalities just need to catch up in developing comprehensive land use plans.

Question: The Wilmington Wastewater Treatment Plant discharges the same amount of water that we use each day as drinking water. So, why aren't we using this wastewater for our water supply?

Answer: Mr. Jamison - The problem is the public perception behind wastewater reuse as well as the infrastructure needed but it could be an option.

Answer: Mr. Bross – Additional treatment facilities would be needed to make the wastewater potable for drinking water purposes.

Question: A change in the mission is needed for the Water Supply Coordinating Council to reflect the demand side as well as supply side. If the WSCC would do an economic water demand management pricing study, what is the estimated cost of such a project?

Answer: Paul - It depends maybe upwards of $100,000. We would need to assign some prices to random samples to simulate price elasticity.

Question: What would a priority list of water supply options look like and how would you come up with it?

Answer: Kevin Vonck - We would get input from a survey of the Drought.02 forum participants and then go back to the Water Supply Coordinating Council to make a decision.

Results of Water Supply/Demand Survey
Delaware Policy Forum DROUGHT.02
October 9, 2002

Introduction

On October 9, 2002, the University of Delaware Institute for Public Administration co-sponsored a Delaware Policy Forum entitled Drought.02 where participants from Delaware and surrounding states gathered to discuss and debate water supply and demand issues. Martin Wollaston and Bill McGowan developed a survey which they distributed to participants in the forum to summarize their opinions on the various Delaware water supply topics. Ninety-seven (97) attendees participated in the survey. The following sections of this report include the compiled results of the survey.

Methods

In order to tabulate the data from the surveys, the information was transferred into a spreadsheet that was used to determine the results. Each of the forum participants were asked to answer the following questions as part of the survey:

Background questions:

- Do you live in Delaware? ……. Yes No
- Do you receive your drinking water from a public water supply system in New Castle County? ……..…….. Yes No
- Do you pay a water bill directly or is it part of your rent? ……Pay Bill Rent
- Do you pay property taxes? ……...Yes No

1. Rank the following alternatives for addressing our water needs with 1 the highest (most favored) response and 11 the lowest (least favored):

_____ Increase the price of water, reducing demands instead of building new supplies.
_____ Build more surface water storage facilities (reservoirs) for untreated water.
_____ Pursue more groundwater storage projects (aquifer storage and recovery).
_____ Use treated wastewater to augment drinking water supplies (direct reuse).
_____ Use wastewater to augment streamflow and meet instream flow needs (indirect reuse).
_____ Build desalination facility to use saltwater (e.g. Delaware River) for water supply.
_____ Increase the size of the City of Wilmington Hoopes Reservoir.
_____ Build more treated water pipelines from out of state (PA. / MD.) water suppliers.
_____ Build pipeline under/across the C & D Canal to move groundwater north.
_____ Continue to use mandatory water use restrictions to reduce demands during droughts.
_____ Do nothing, water supplies are adequate to meet current and future demands.

2. Answer the following questions concerning the amount of water you use and the amount you would be willing to pay to improve the water supply in New Castle County:

How much do you estimate you pay annually for your household water use? _____

How many thousands of gallons do you think your household uses a year? _____
Would you be willing to pay $200 more a year to ensure year-round unrestricted use of water?
Yes No
Would you be willing to pay $400 more a year to ensure year-round unrestricted use of water?
Yes No

3. Currently there are six (6) water suppliers north of the C & D Canal in New Castle County – four are publicly operated entities (Delaware City, Newark, New Castle, and Wilmington) and two are investor-owned utilities (Artesian and United Water Delaware). Each supplier manages its supplies independently although most can sell water among themselves via interconnections.

Which one of the following governance options is most preferable for managing water supplies in New Castle County (choose only one)?
_____ Regional water district office established to oversee water use and land use decisions
_____ Water Supply Coordinating Council as presently mandated under state law
_____ Consortium of water suppliers governed by a board of directors

4. During a drought emergency in Delaware, restricting outdoor water use activities primarily reduces water demands.

Rank the following actions that can be used to lower water demands during drought emergency conditions with 1 the highest (most favored) response and 4 the lowest (least favored):

_____ Establish mandatory reductions for all customers (e.g. 10% reduction for all customers enforced from meter readings with penalties)
_____ Ration water use by odd – even addresses (outdoor uses permitted by street address)
_____ Restrict all lawn watering and car washing
_____ Establish drought emergency water rates where the cost of water is 3 to 4 times higher but water use is unrestricted

Results

Figure 1 details the percentage of participants that lived in Delaware showing that 81% of those surveyed live in Delaware while 19% were from other states.

Figure 2 illustrates that 63% of participants receive their drinking water from New Castle County and 37% do not.

Property taxes are paid by 82% of individuals and rent is paid by 18% as seen in Figure 3.

Figure 4 confirms that 79% of those surveyed pay for water through a billing process while 19% have the cost included in their rent and 2% pay by other means.

Figure 5 details the annual amount paid for household water use by all participants in the forum. The most individuals, 16, estimated they pay between $200-$399 for water. Ten people pay $100-$199 while 8 pay $500-$599 and 6 each pay either $0-$99 or $500-$599. The least amount of people, 4, pay $600 and over for their water.

Figure 6 is similar to Figure 5 but shows the annual amount paid for household water use only by those who live in Delaware. The most common amount paid is $300-$399 by 14 people and next highest is $200-$299 by 12 people. Ten individuals pay $100-$199, 7 pay $500-$599, and 5 pay $0-$99. The least amount of those from Delaware, 3 each, pay either $400-$499 or $600 and over.

Figure 7 illustrates the responses by all participants as to their willingness to pay $200 more a year to ensure year-round unrestricted use of water. While 57% said that they wouldn't mind the increase, 43% would be opposed. When the same question was posed just to those from Delaware, as seen in Figure 8, the same results were found. Fifty-seven percent would pay the increase but 43% would not.

Figure 9 shows the responses by all participants to increasing their amount paid for water by $400 to ensure year-round unrestricted use of water. Only 17% would be willing to support the increase while 83% would not pay the extra. Just 16% of those from Delaware would not mind an increase and 84% would disagree with the increase as seen in Figure 10.

Figure 11 shows that the most participants, 27, estimated they use anywhere from 0-39,999 gallons annually. Also, 15 individuals use 40,000-79,999 gallons, 14 individuals use 80,000-119,999 gallons and only 7 use more than 120,000 gallons. Figure 12 details the use of water by those who live in Delaware. Twenty-five people in Delaware use 0-39,999 gallons, 13 people use 40,000-79,999, 10 people use 80,000-119,999 and only 6 people use more than 120,000 gallons.

Figure 13 shows the ranking of options for addressing the water needs of Delaware by all participants of the forum. The most favored option was to increase the size of Hoopes Reservoir while the second preferred option was to use treated wastewater for indirect reuse. The rest of the options were ranked in increasing order as follows: pursue more groundwater storage, increase price of water- reducing demand, build more surface water storage, use treated wastewater for direct reuse, use mandatory water restrictions, desalination, build pipelines across the C and D Canal, build pipelines from out of state, and least preferred: Do nothing.

Figure 14 illustrates the same options for addressing the water needs of Delaware by those who live in Delaware. The most favored option was to increase the size of Hoopes Reservoir while the second option was to use treated wastewater for indirect reuse. The rest of the options were ranked in order of decreasing preference as follows: increase price of water- reducing demands, pursue more groundwater storage, build more surface water storage, use treated wastewater for direct reuse, desalination, use mandatory water restrictions, build pipelines across the C and D Canal, build pipelines from out of state, and lastly: do nothing.

Figures 15 and 16 are concerned with preferable governance options for managing water supplies in New Castle County. Surveying all participants in the forum, 50% preferred the Water Supply Coordinating Council as the governance option for water supply while 42% would like to see a regional water district office established, as seen in Figure 15. Six percent wanted a consortium of water suppliers governed by a board of directors and 2% had another option.

Figure 16 shows that 45% of those who live in Delaware equally support either the Water Supply Coordinating Council or a regional water district office as a governing board. Seven percent prefer a consortium of water suppliers governed by a board of directors and 3% had another option.

Figures 17 and 18 provide a ranking of several actions that can be used to lower water demands during drought emergency conditions. Figure 17 indicates the most preferred option as surveyed from all the

participants was to restrict all lawn watering and car washing. Following that option in decreasing order of favor was: mandatory reductions for all customers, ration outdoor use by odd-even addresses and establish drought emergency water rates as the least favored option.

Figure 18 shows the most preferable option for those who live in Delaware as restrict all lawn watering and car washing. The rest of the options were ranked in decreasing preference as follows: establish drought emergency water rates, establish mandatory reductions for all customers, and ration outdoor water use by odd-even addresses.

Conclusions

Several conclusions can be drawn from the survey data collected at Drought .02, a Water Policy Forum. With reference to the background data, the majority of individuals were from Delaware, receive their drinking water from New Castle County, pay property taxes and pay for their water through a billing process. The most common amount paid by those who live in Delaware is $300-$399 per year for household water use while paying $600 and over is very rare. The majority of Delaware residents use 0-39,999 gallons of water annually.

Conclusions can be made about various supply and demand issues that face Delaware and how its residents would like to see them solved. When asked whether they would pay more annually to ensure year-round unrestricted use of water, a slight majority (57%) of Delaware residents said they would not mind a $200 increase but only 16% would be in favor of a $400 increase. The most favored option for addressing the water needs of Delaware included increasing the size of Hoopes Reservoir in Wilmington while doing nothing was the least favored by those in Delaware.

The choice of governance options for managing water supplies in New Castle County was split equally between the Water Supply Coordinating Council and a regional water district office. Finally, the option most favored by Delaware residents to lower demands during drought emergency conditions was the restricting of all lawn watering and car washing.

Figure 1: Percentage of those who live in Delaware

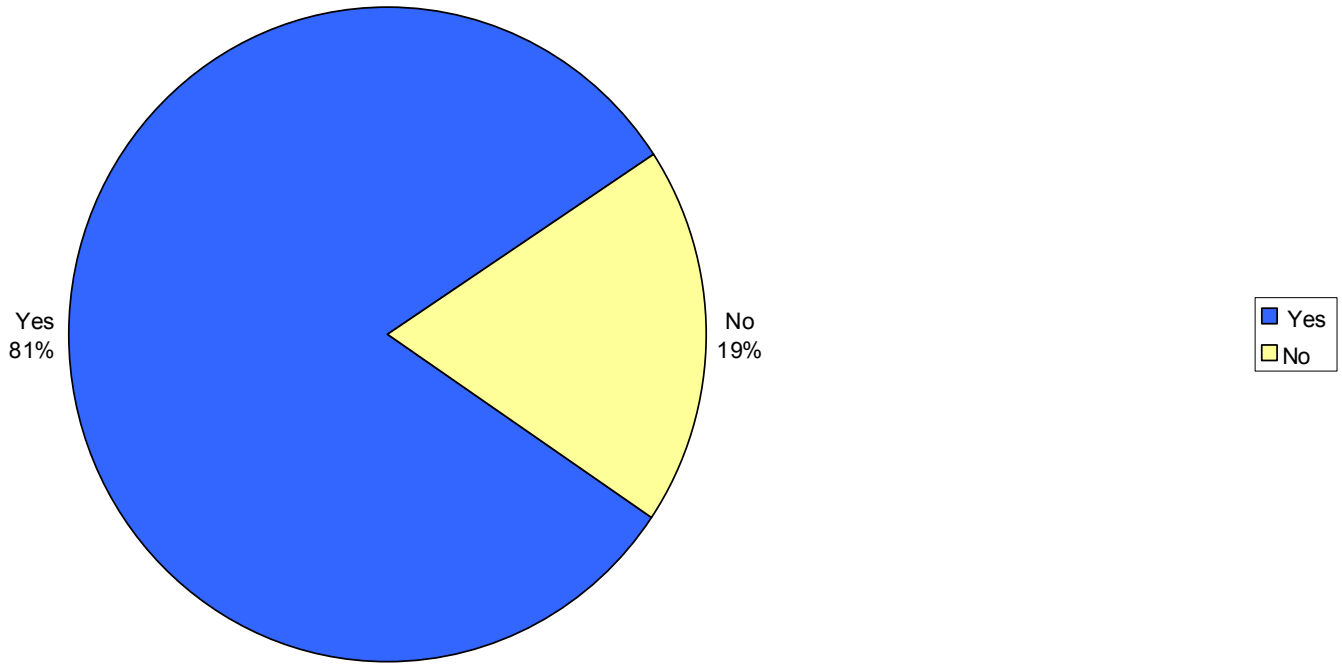


Figure 2: Percentage of those who receive drinking water supply from NCC

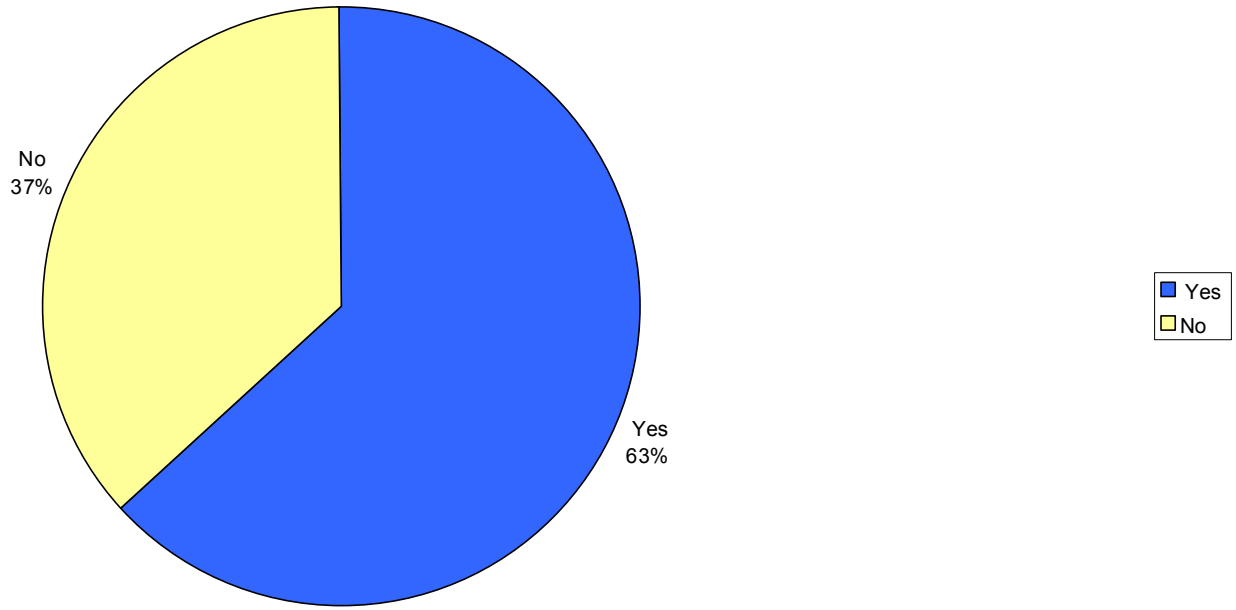


Figure 3: Do you pay property taxes?

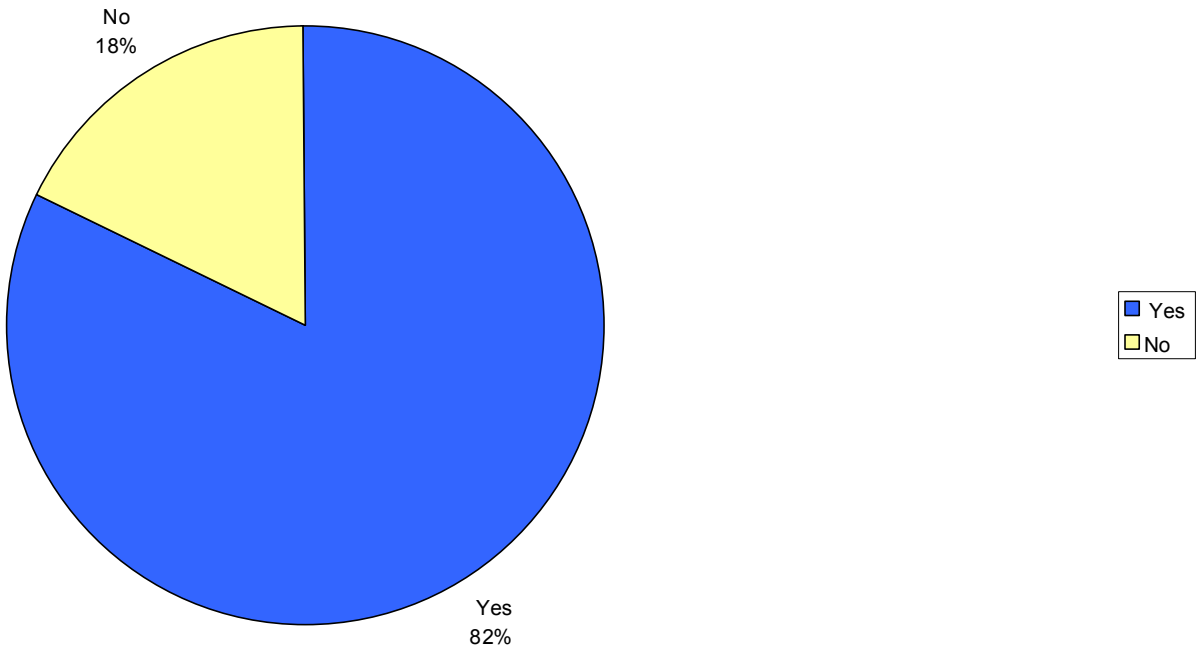


Figure 4: How you pay for water

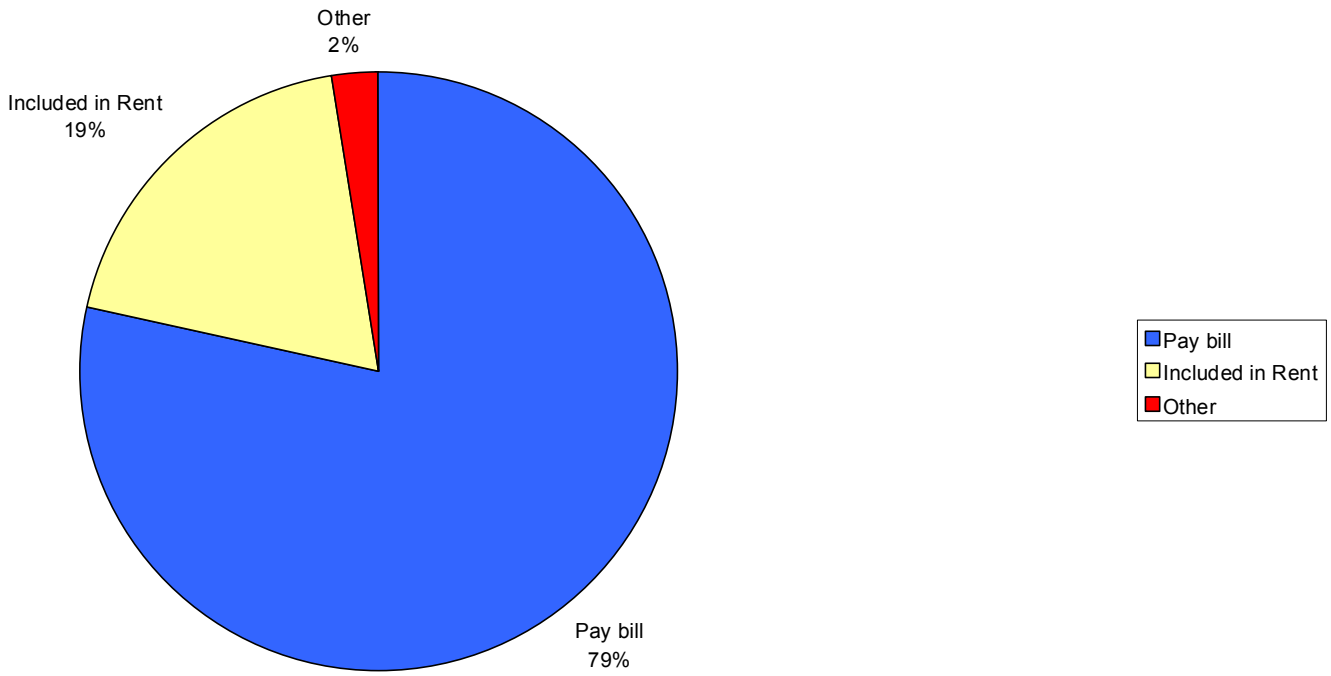


Figure 5: Amount paid annually for household water use by all participants

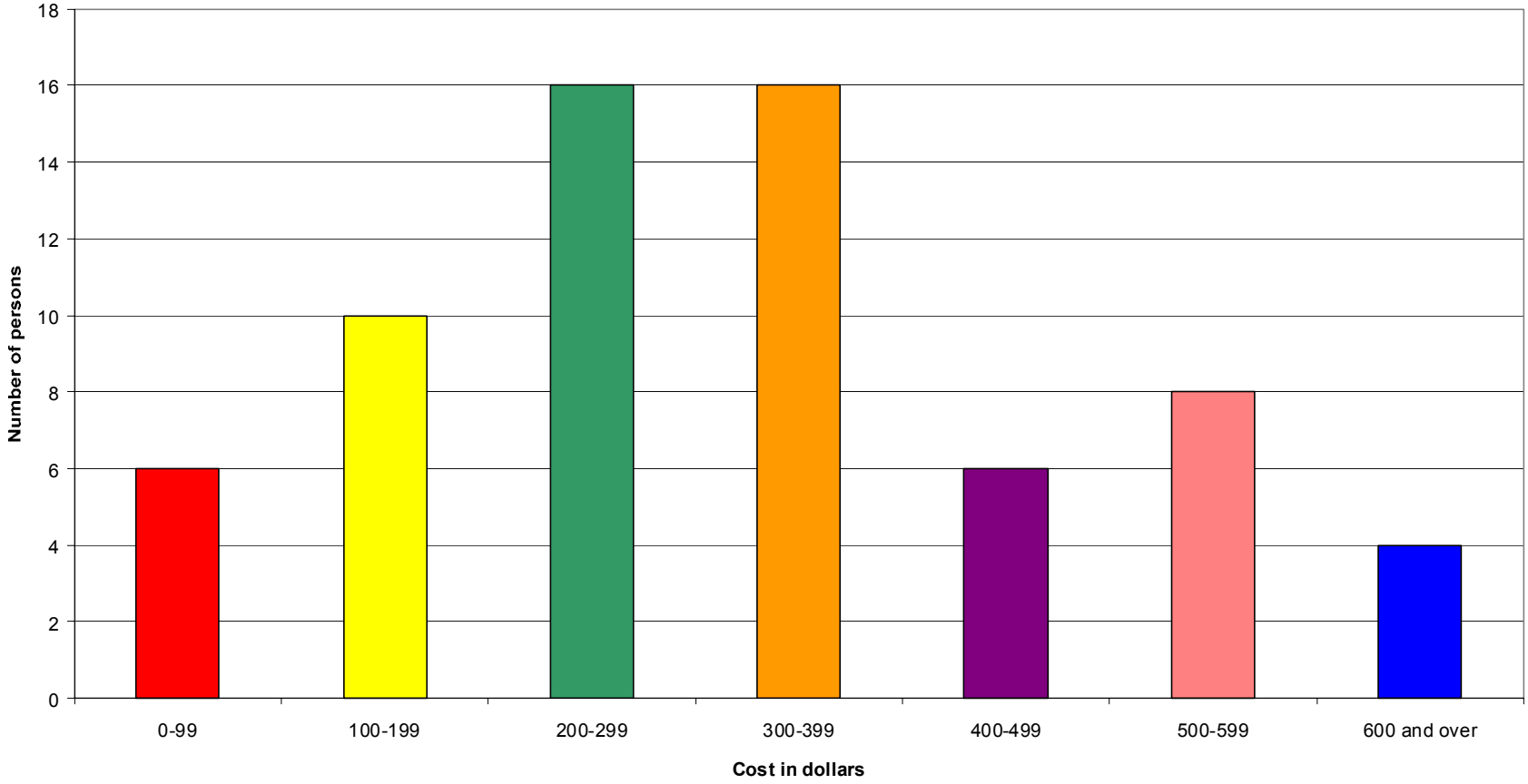


Figure 6: Amount paid annually for household water use by Delawarians

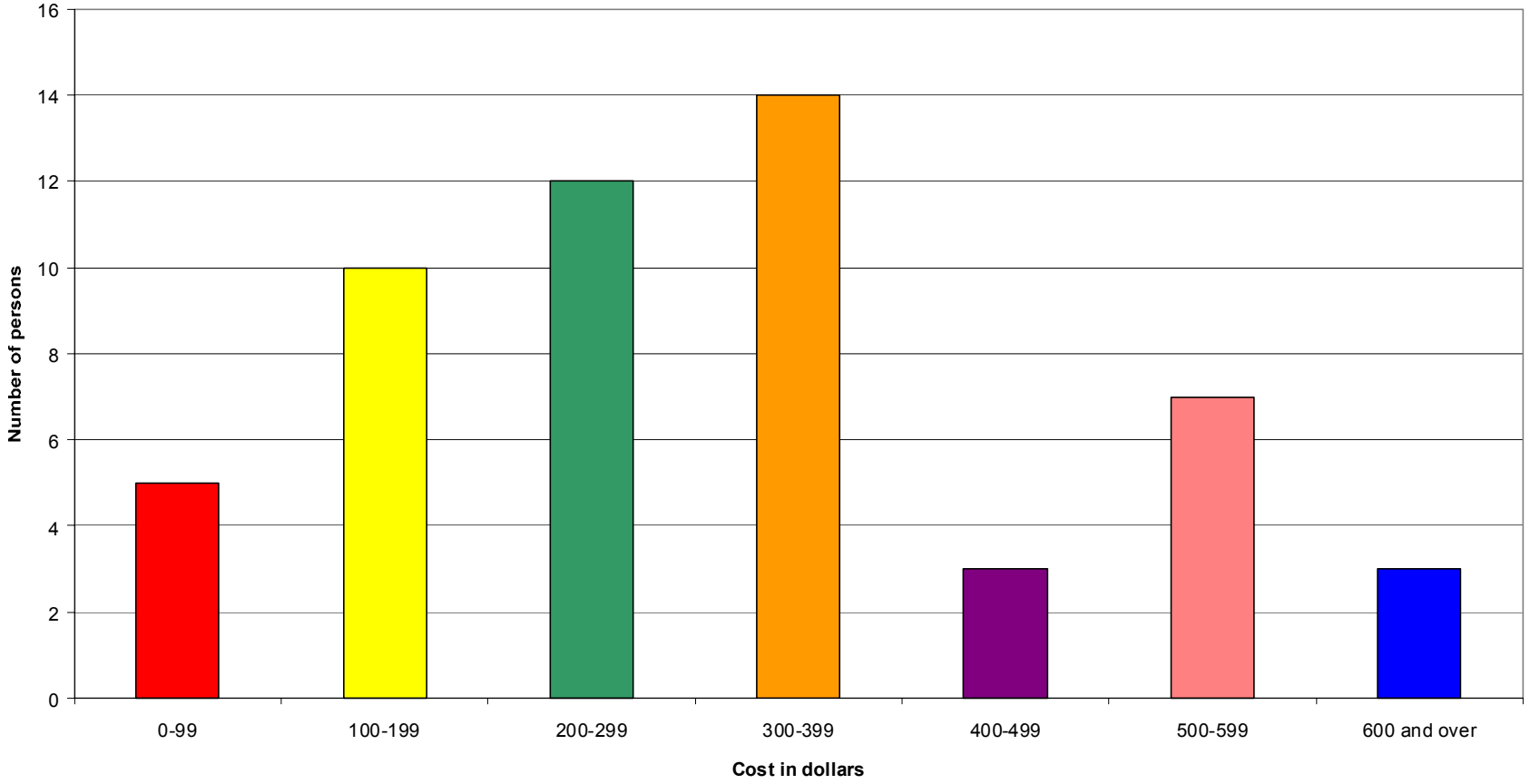


Figure 7: Would you be willing to pay $200 more a year to ensure year-round unrestricted use of water? (all participants)

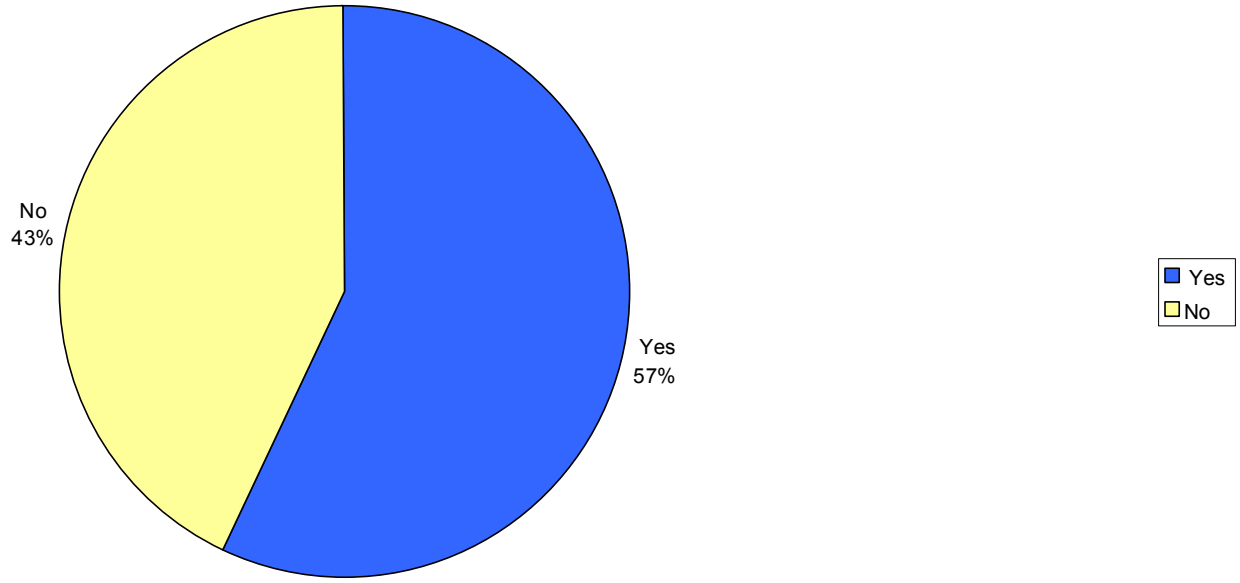


Figure 8: Would you be willing to pay $200 more a year to ensure year-round unresticted use of water? (Delawarians)

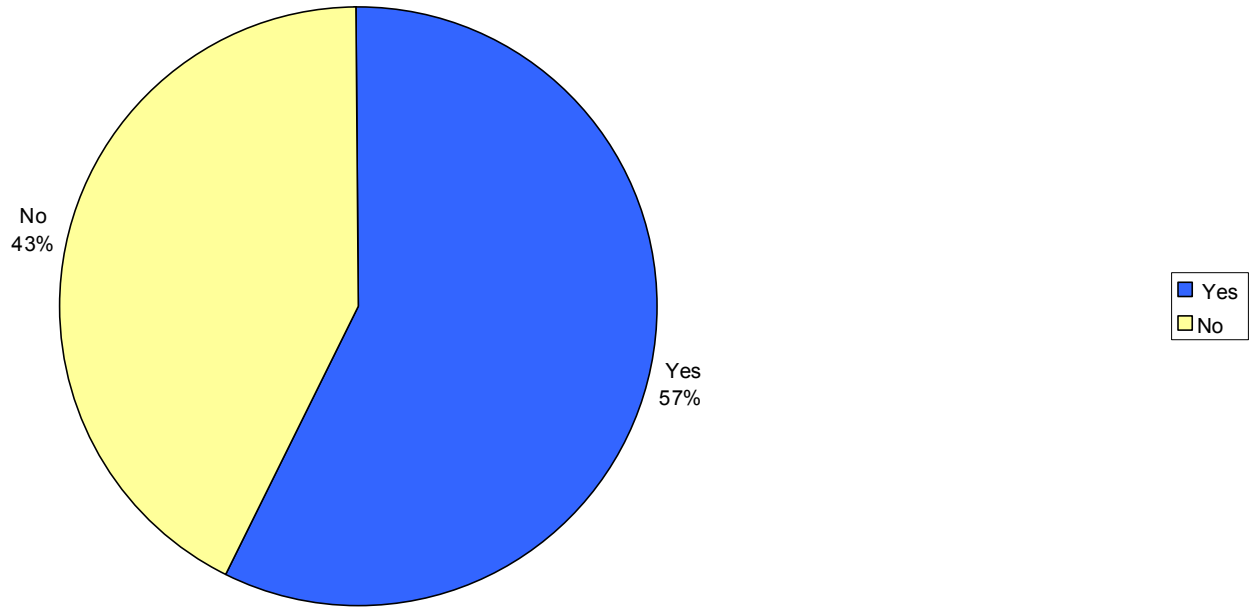


Figure 9: Would you be willing to pay $400 more a year to ensure year-round unrestricted use of water? (all participants)

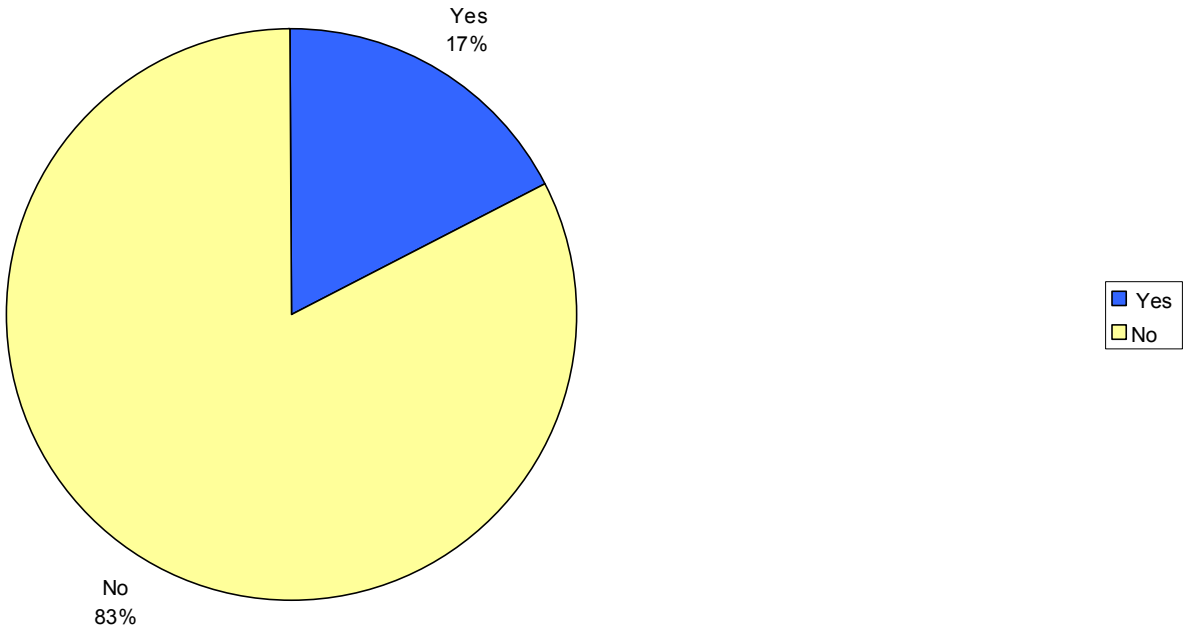


Figure 10: Would you be willing to pay $400 more a year to ensure year-round unrestricted use of (Delawareans)

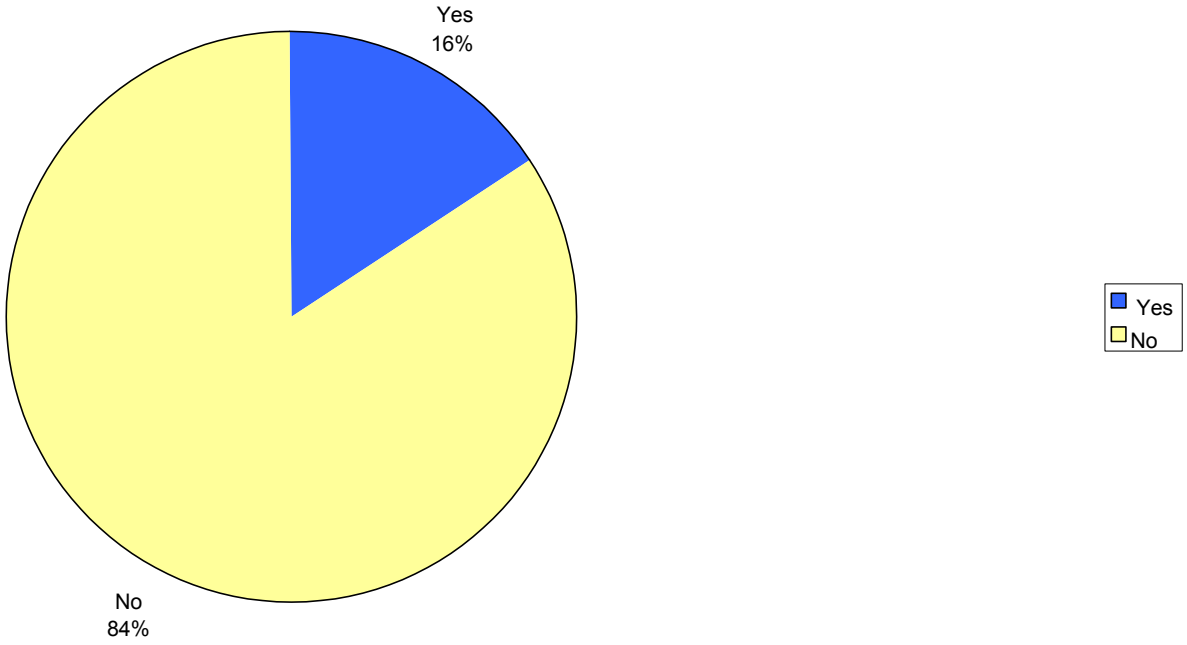


Figure 11: Number of gallons of water used per year for all participants

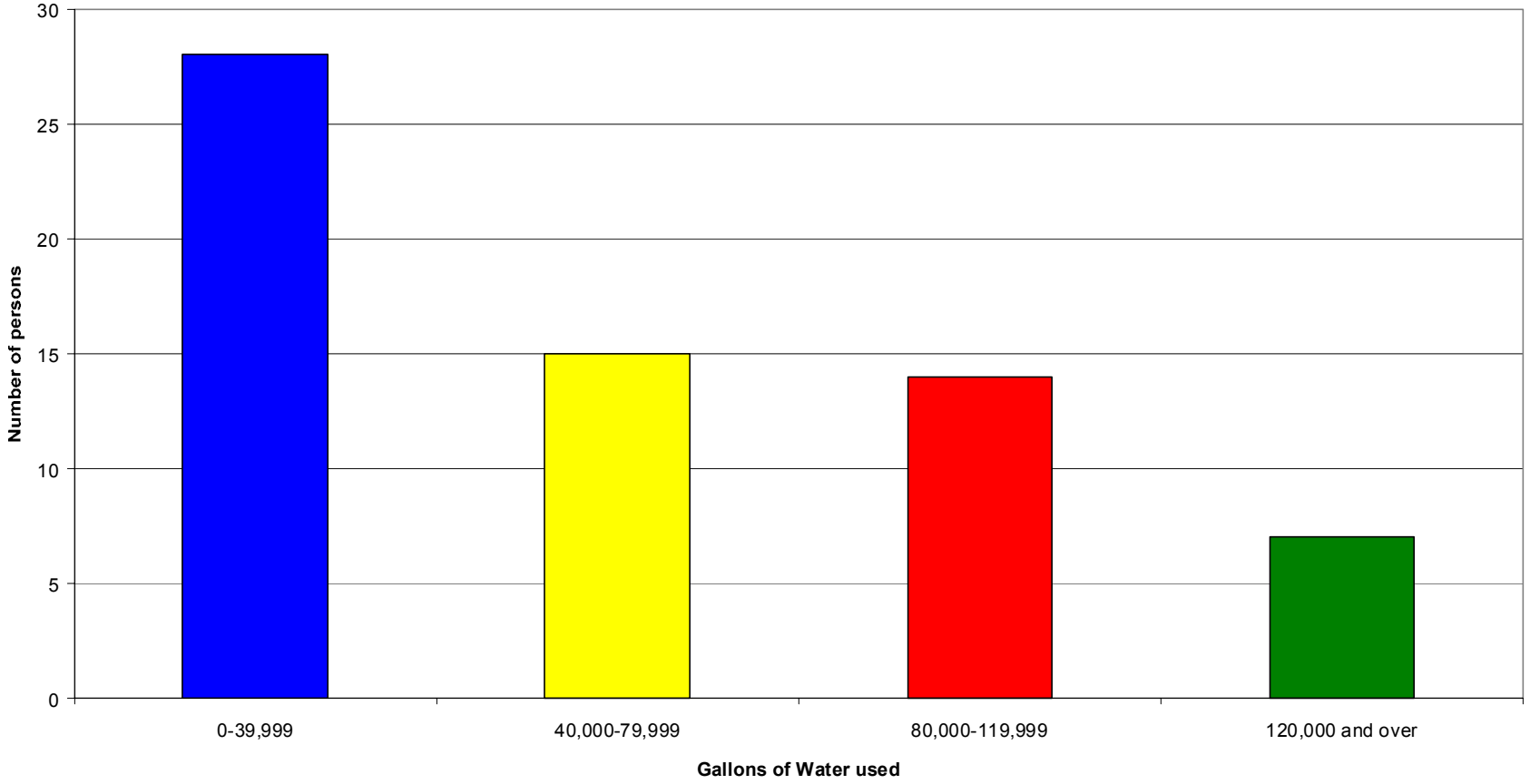


Figure 12: Number of gallons of water used per year for Delawarians

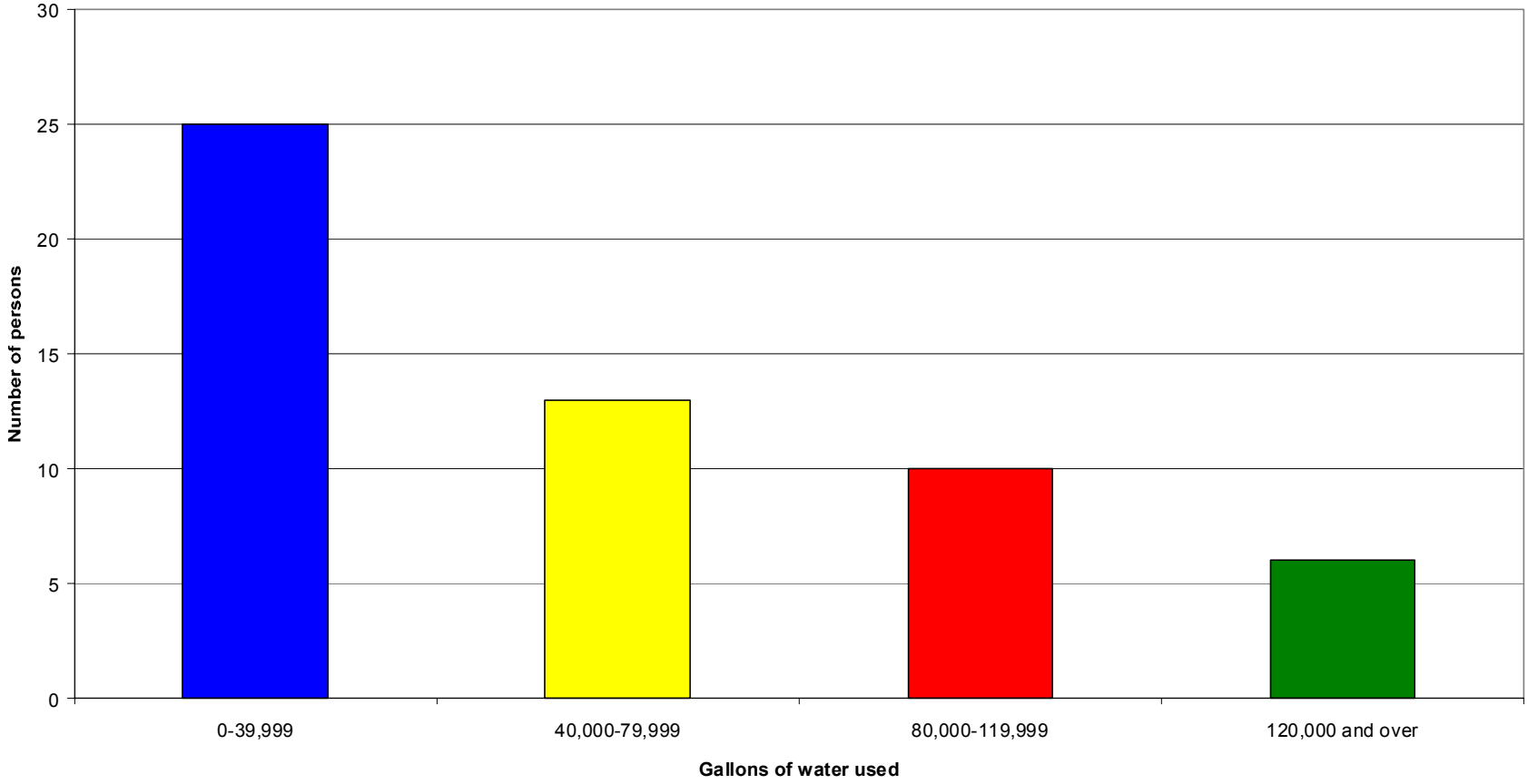


Figure 13: Average ranking of options for addressing water needs by all participants

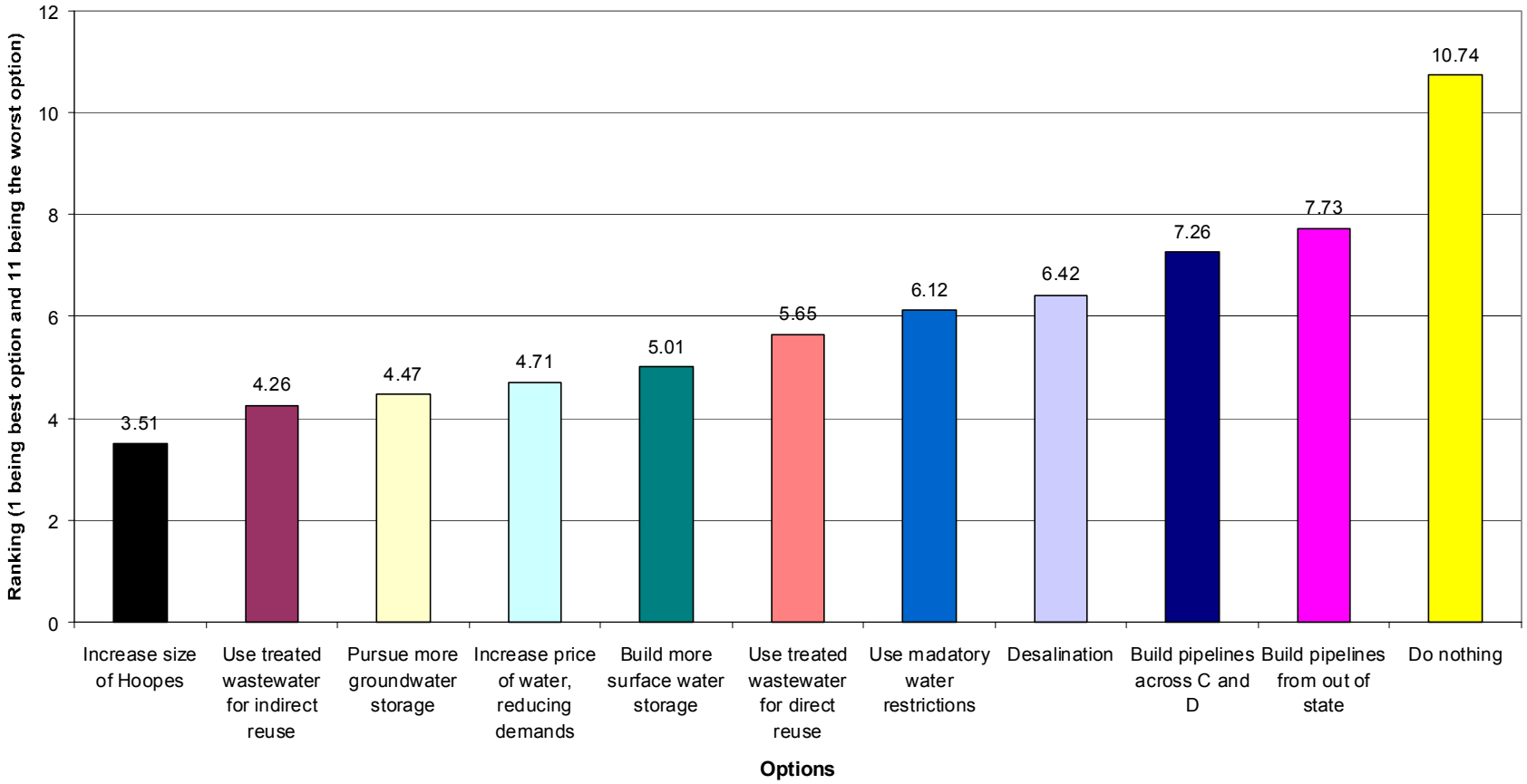


Figure 14: Average Rankings of alternatives to address Delaware water needs by Delawareans

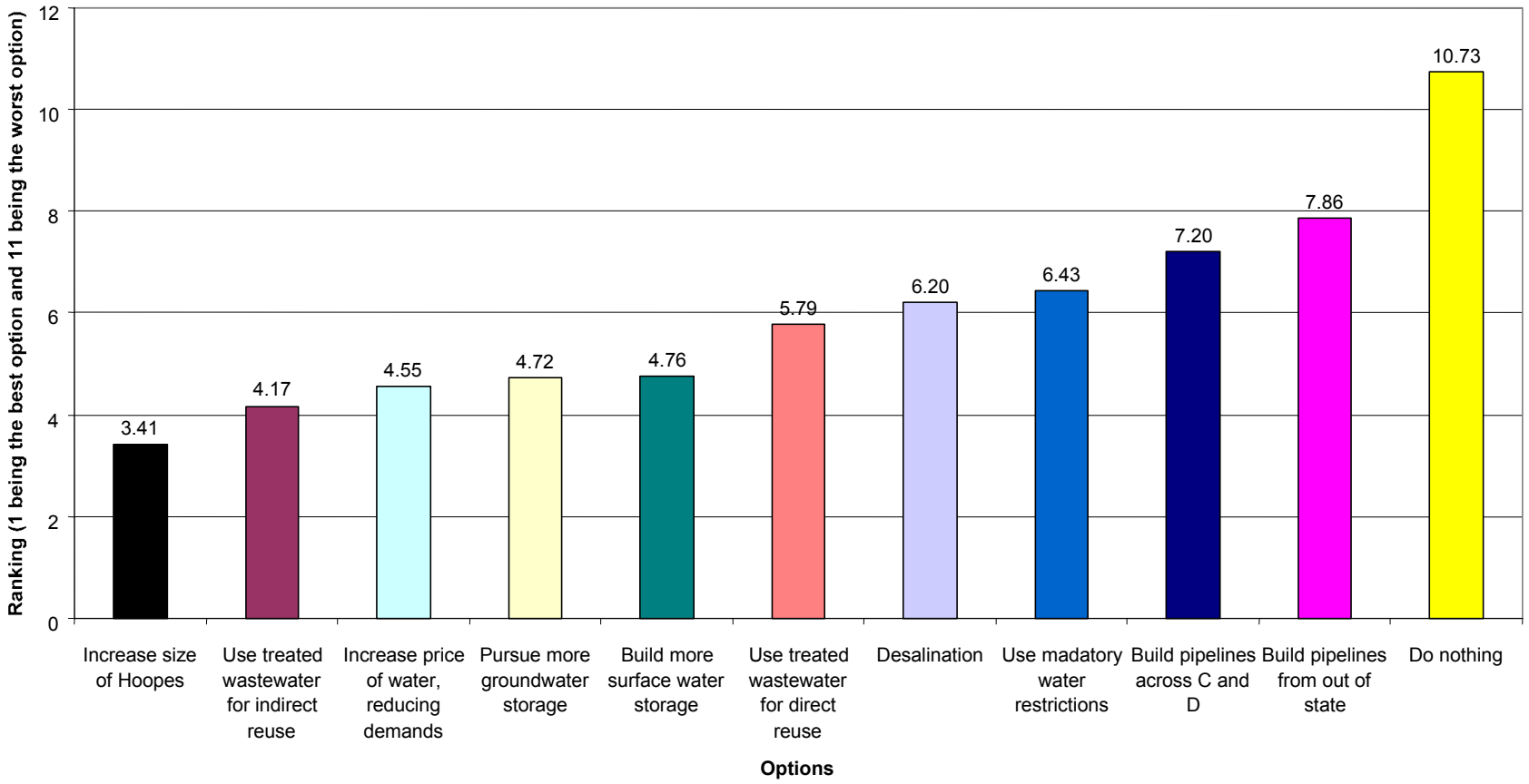


Figure 15: Governance options for managing water supplies in New Castle County by all participants

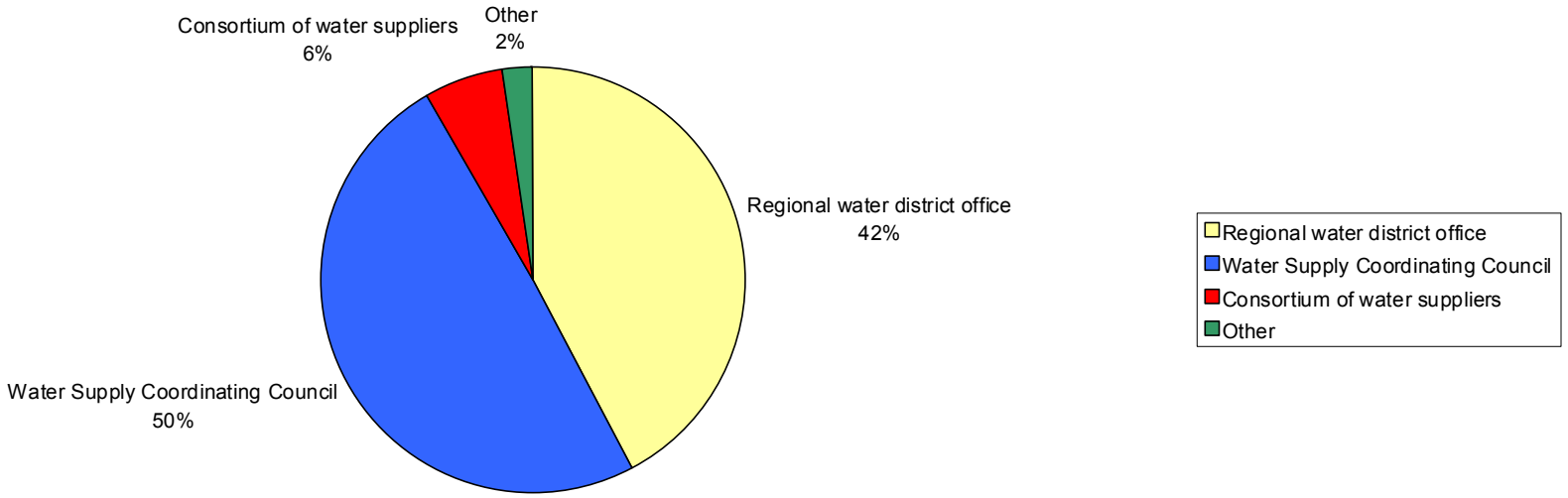


Figure 16: Governance options for managing water supplies in New Castle County by Delawareans

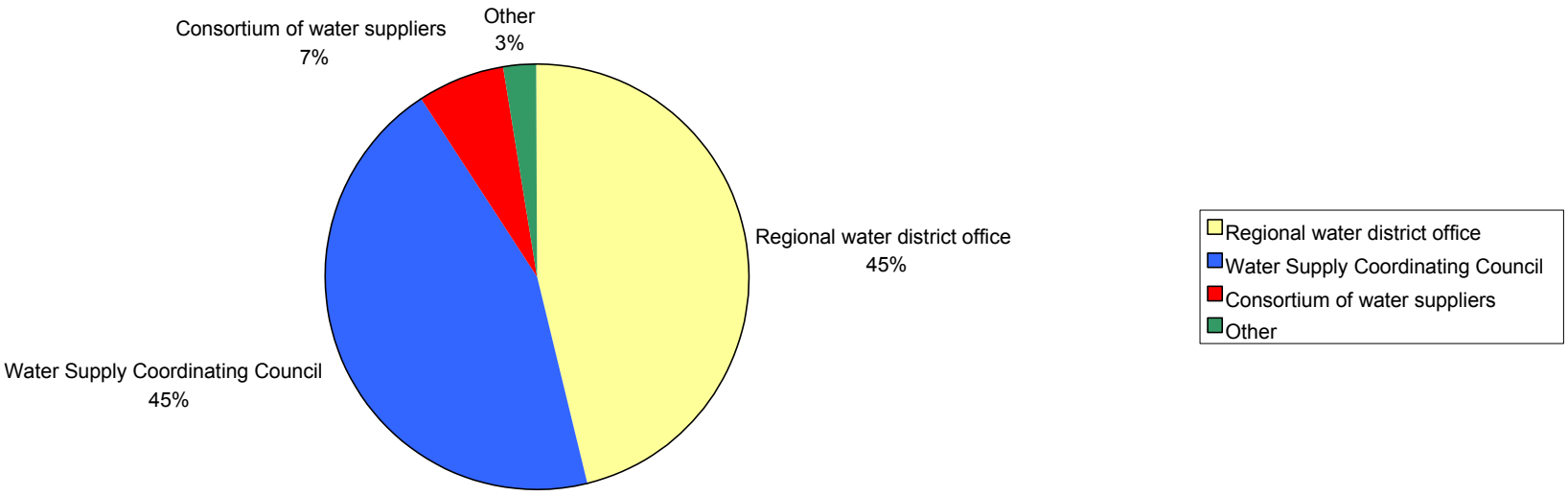


Figure 17: Ranking of actions used to lower water demands during a drought by all participants

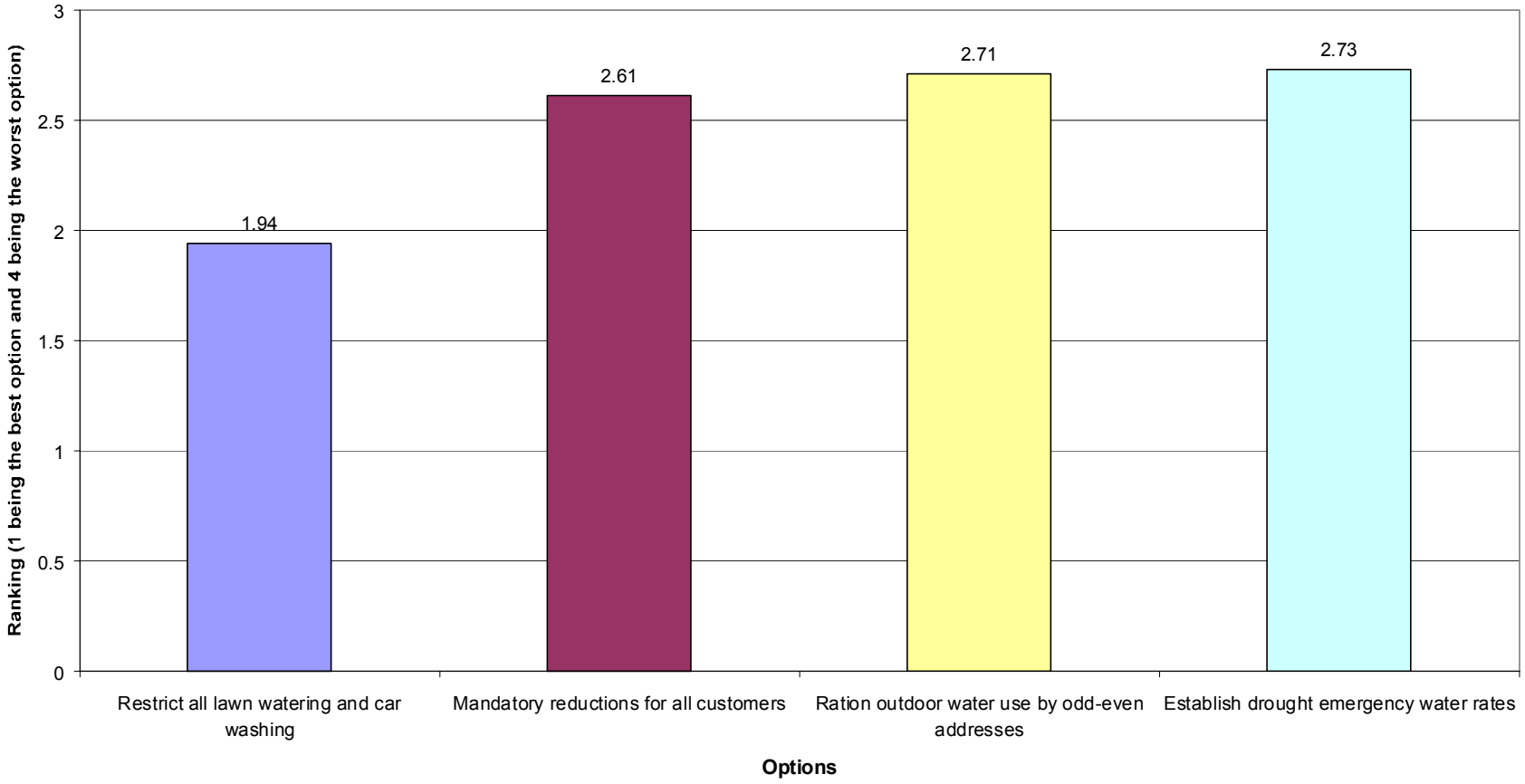
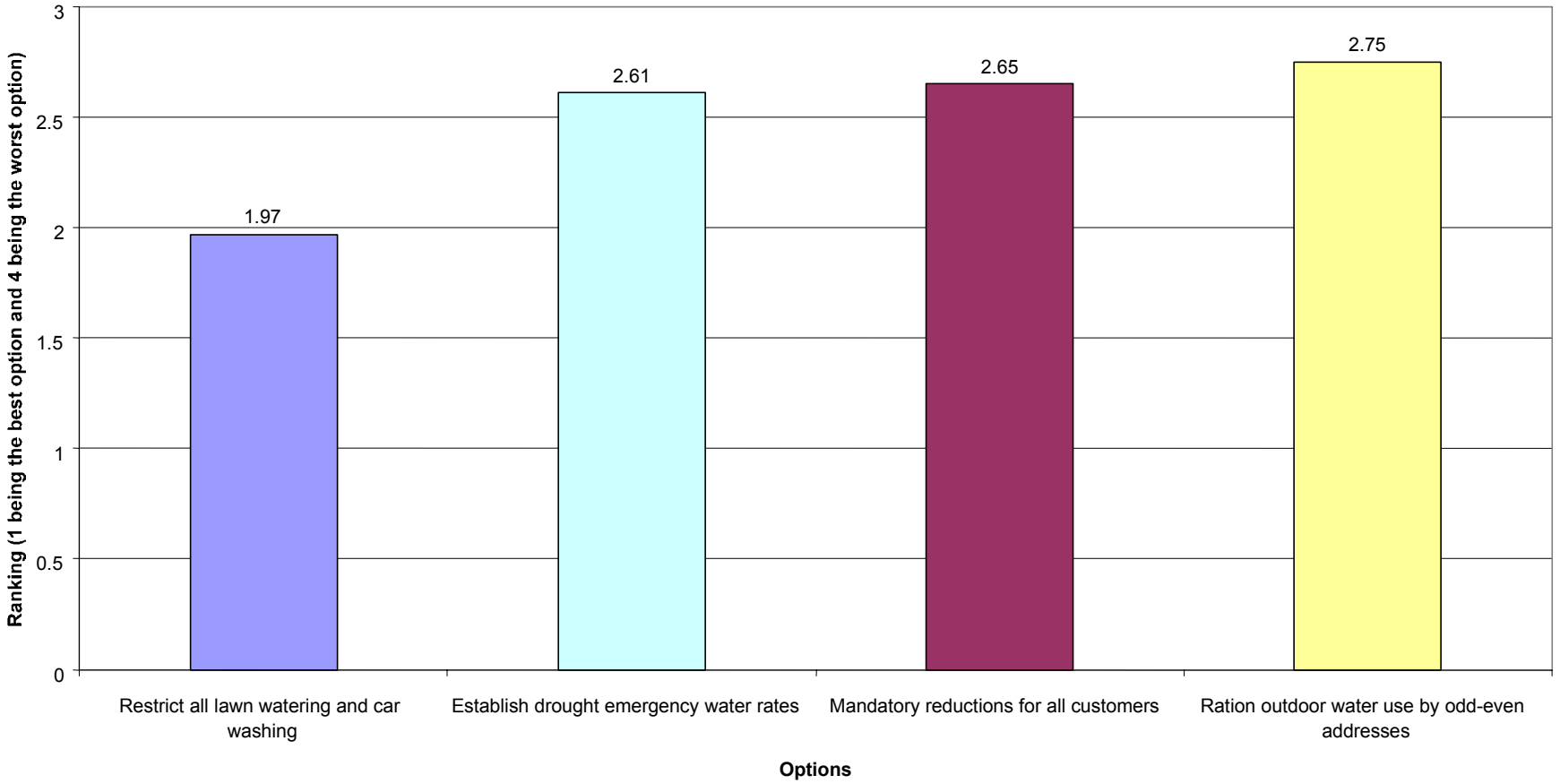


Figure 18: Ranking of actions that can be used during a drought to lower water demands by Delawareans



2002 Water Policy Forum Participants

Remarks and Presentations

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The **Institute for Public Administration (IPA)** seeks to link the research capacity and resources of the University of Delaware with the management and information needs of local, state and regional governments in the Delaware Valley. IPA provides assistance to agencies and local governments through direct staff assistance and research projects as well as training programs and policy forums. The **Water Resources Agency (WRA)** in IPA provide water resources assistance to state and local governments and the public in Delaware and the Delaware Valley through the University's service, education, and research roles. Under state law, the WRA was appointed the State's Water Coordinator. Dr. Jerome Lewis is the director of the Institute. He can be contacted at 302-831-8971.

Delaware Department of Natural Resources and Environmental Control is the guardian of water resources in Delaware and is responsible for the regulation and allocation of public drinking water supplies through the Division of Water Resources. Mr. Kevin Donnelly is the director of the DNREC Division of Water Resources and is the Chair of the Delaware Water Supply Coordinating Council.

The **Delaware Water Resources Center** is part of a network of 54 water resources institutes nationwide. It is funded by the U.S. Geological Survey and is located within the University of Delaware's College of Agriculture & Natural Resources. Dr. Thomas Sims is the director of the Center.

For information on water-related issues, contact:

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