

*“People say that if you find water rising up to your ankle, that’s the time to do something about it, not when it’s around your neck.”*

*—Chinua Achebe*

**Debra Shore, Commissioner  
Metropolitan Water Reclamation District**



**2013 ANNUAL REPORT**

A decade ago, the annual budget statement for the Metropolitan Water Reclamation District was all about numbers—fund balances, shifts from the Corporate Fund, transfer of interest income, staffing. Today the numbers remain but there’s a healthy dash of vision added, aspirational and transformative: “The District is shifting from a waste treatment utility to a resource recovery utility.” All those things that we once considered waste—the biosolids, methane gas, nutrients in the wastewater, even the treated water itself—have value and now the District is seeking to capture and monetize that value for the benefit of Cook County taxpayers and the wider region. It’s beyond exciting.

# Big Water, April Flood

It's official: April 2013 was Chicagoland's wettest on record. That's according to the National Weather Service, which measured an astounding 8.68 inches (surpassing the previous record of 8.33 inches set in 1947). Chicago received 5.55 inches of rain between April 17th and April 18th—the highest two-day average for any April on record. The effects were immediate. Stormwater flooded neighborhoods, inundated cars and porches, surged into homes, overwhelmed both rivers and infrastructure, and even contributed to forming a sinkhole that swallowed three vehicles on Chicago's South Side.

An inch of rain falling evenly across the 946 square miles of Cook County equals 16 billion gallons. Some of that rain, of course, gets absorbed by the landscape, soaking into fields and woods. In Chicago and the 50 other municipalities that have combined sewers, the rain falling on streets, parking lots, and buildings runs off and into storm drains that flow into the sewers leading to wastewater treatment plants. (In newer towns that have separate storm and sanitary sewers, the storm system conveys rainwater directly into nearby rivers and streams.)



**SUNKEN VEHICLE, RIVER GROVE**

PHOTO: JOHN TRILIK, COURTESY OF THE NATIONAL WEATHER SERVICE

Consider, however, that much of Cook County is impervious surface: 42 percent by some estimates. By paving over the landscape, we've removed the land's natural ability to absorb water and given rain nowhere to go.



**IMPERVIOUS SURFACE GROWTH IN DES PLAINES OVER 60 YEARS**  
COURTESY OF OPENLANDS

The combination of intense rainfall, limited green space, and saturated soils meant the municipal and countywide sewer and stormwater pipes were going to fill. Fast. The Metropolitan Water Reclamation District's (MWRD) stormwater storage system has a total capacity of 18.25 billion gallons—but some 80 billion gallons of rain fell on Cook County.

In severe storms, when the amount of rain overwhelms the capacity of the local sewers, and when overflows fill the canals and raise water levels in the Chicago River, the MWRD must release excess water to the lake to prevent further flooding. This is called a reversal.

On April 18, MWRD began discharging stormwater to the lake at all three locations: Wilmette Harbor, the Chicago River Controlling Works, and O'Brien Lock on the Cal-Sag Channel. These discharges, amounting to billions of gallons of stormwater mixed with some sewage, continued until the next morning.

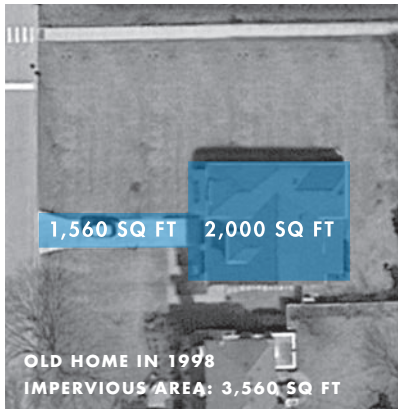
Still, with Deep Tunnel full, the reservoirs full, the waterways rapidly rising, the ground already saturated from Wednesday's rain and more rain still falling, where could all that water go? Into our basements, flooding streets and buildings, overflowing riverbanks.

# Big Water, April Flood

## The Limitations of Pipe

On the block where I live in Skokie, four older homes have been torn down in recent years and new, larger homes built on the same lots. These new homes cause more runoff because they have more impervious surface—about 200,000 more gallons of stormwater flowing into the sewers each year. But the pipe receiving this additional stormwater is the same size laid down the middle of the street in the 1950s.

Get the picture?



**BIGGER HOMES INCREASE RUNOFF AND REDUCE PERMEABILITY**

## Prepare, But Not Prevent

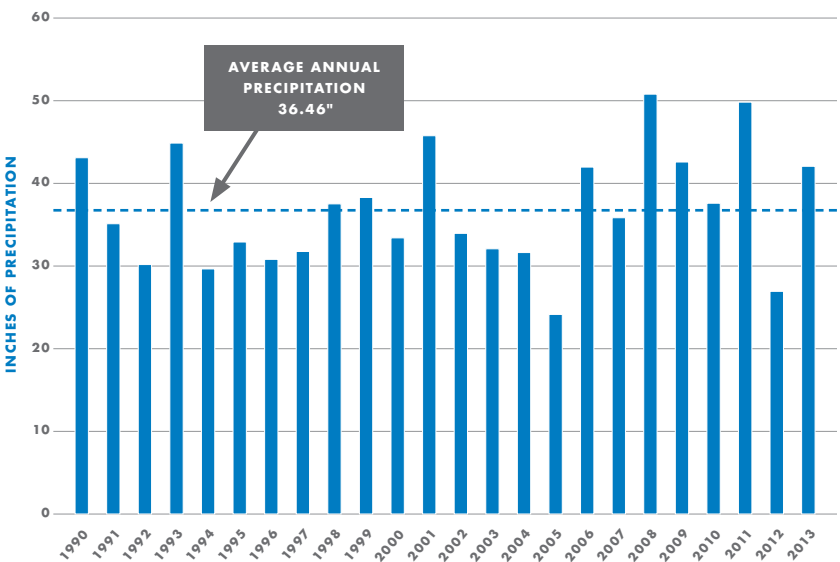
Announcement: No municipal system is designed to hold or convey the amount of water that deluged our landscape in April. Had the storm been a tornado or a hurricane, we would have prepared for the predicted disaster, but we couldn't have prevented it. Similarly, we have experienced three rainstorms of unprecedented magnitude in the last four years (in July 2010, July 2011, and April 2013). The best available science indicates that these more intense, more localized storms are a symptom of global climate change—what some are calling “climate chaos”—and we must adapt as well as we can. We can prepare for them, but we cannot prevent them.

## How to Adapt?

Green infrastructure, that suite of techniques designed to capture rain where it falls and keep it out of the sewers, won't solve all our storm problems, but it can help. By absorbing more rain, green roofs, permeable pavement, vegetated swales at roadsides, rain gardens, and rain barrels can all slow the flow of rain into the sewers, giving them added capacity to handle stormwater. These techniques, if implemented widely, may effectively turn a four-inch rainstorm into a two-inch rainstorm. Disconnecting downspouts, making sure sump pumps discharge onto lawns and not into sewers, delaying showers, laundry, and dishwashing during storms—all these will help as well. But we may also need to invest in overhead sewers and other approaches to protect our homes, and recognize that rain causes flooding and our basements may become temporary storage areas now and in the future.

The MWRD is encouraging each municipality to develop 100-year stormwater plans and find solutions to local flooding. In 2013, the District spent more than \$30 million in contracts to address flooding problems. More project support is coming in 2014. Water flows across political boundaries; our solutions must as well.

### ANNUAL PRECIPITATION IN CHICAGO SINCE 1990

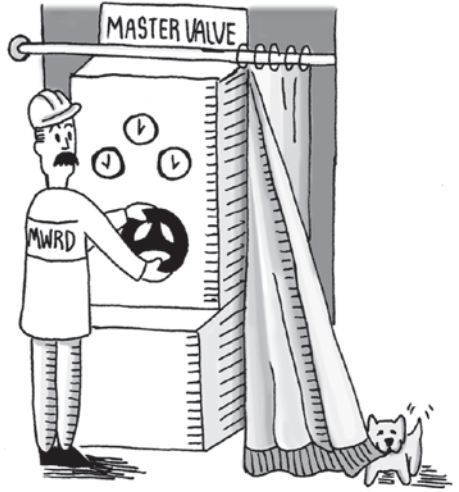


# Big Water, April Flood

## The Myth of the Secret Valve

Often in the course of severe storms, people in various parts of Cook County will experience water rising up into their basements and later a sudden release and swift emptying of water down the drain. “Somebody must have opened the gates to discharge water to the lake!” we hear people say. “Why didn’t they open the gates sooner to prevent flooding?” “Who’s the guy with his hand on the valve—why didn’t he open it sooner?!!”

I am here to report that there is no such valve, no secret key or mystery plug. When water from sewers backs up into basements or ponds in streets, it means that the local pipes are full. They can’t hold any more water.



When people witness a sudden release, it means that the sewer system has emptied enough to allow more water to flow into it. Even though rain may still be falling, the rate may have abated just enough to allow more capacity in the sewer system. It’s aggravating, to be sure, and mystifying, but there’s no man hidden behind a curtain pulling levers.

## Watershed Management Ordinance

Cities change with time, and so must the way we manage stormwater. Commercial, municipal, and residential development benefits growing communities, but also poses the risk of making local flooding worse by increasing the amount of impervious surface area. Rain that doesn’t soak into the ground runs off lawns, buildings, and streets, often overwhelming sewer systems, and carrying untreated water to streams or inside homes and businesses. That’s why the MWRD began developing a Watershed Management Ordinance (WMO) in 2007 as a means of mitigating flooding, erosion, and water quality impairments spurred by new upstream developments or redevelopments. The District assembled a Technical Advisory Committee representing municipalities, government agencies, and nongovernmental organizations to help devise an ordinance bringing management strategies up to speed with today’s biggest challenges.

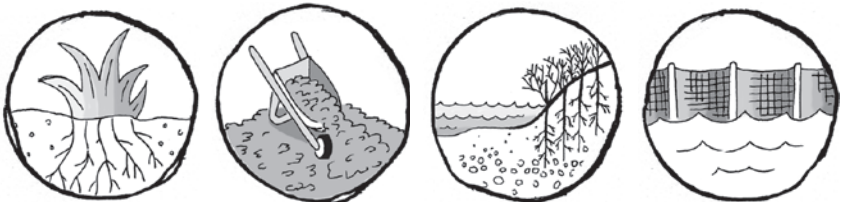


The goal was to set minimum standards across suburban Cook County for retaining stormwater on parcels of a certain size. Some municipalities already have stringent standards, but others do not. (Lake and DuPage Counties have had similar ordinances in place for 20 years.)

The “first flush” of runoff contains most of the oils, dust, particles, and other pollutants washed off impervious surfaces like roads or parking lots. Capturing contaminants is essential for protecting the health of our local waterways and ecosystems so the WMO set standards for dealing with the first inch of rain on a site.

Of course, capturing runoff is only one piece of the puzzle. In the District had to figure out what to do with it. If every property owner released runoff at the same time and rate, we could very well end up with more flooding in downstream communities. What would be a more equitable solution for communities upstream and downstream alike? The District established storage requirements regulating how quickly developments can discharge runoff, gradually tightening the release rate over five years.

Another key component of the ordinance strengthens measures designed to minimize erosion and sedimentation. Waterways constantly detach and deposit small soil particles that, left unabated, can seriously hinder the ability of streams, storm sewers, wetlands, detention basins, and drainage ditches to convey water. That means less capacity to capture stormwater, and more flooding for Cook County. The WMO requires all developments to prevent excessive soil erosion by planting vegetation, mulching, stabilizing banks, or shielding waterways from wind-blown debris and to take other measures to control sediments from running off into rivers.



After a series of public meetings around the county, the Board of Commissioners adopted the WMO on October 3, 2013. A technical guidance manual is being developed, and the ordinance will take effect on May 1, 2014.

# Resource Recovery & Disinfection

## Phosphorus

Have you seen my new prop? This is it—a vial of Crystal Green, which I'm pulling out to display at every occasion because I am so excited about the District's new nutrient recovery project launched last October.



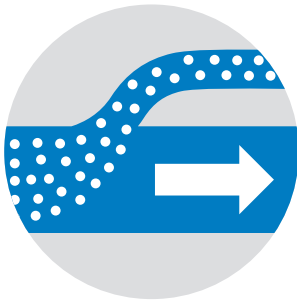
Here's the deal. Nutrient pollution, principally phosphorus runoff, is a vexing problem for lakes and streams because it promotes the growth of algae, which suck up oxygen and choke aquatic ecosystems ("dead zones" in the Gulf of Mexico and the west side of Lake Erie are prime examples). Phosphorus enters our waterways as fertilizer runoff from farm fields and lawns, from failing septic systems, and from wastewater effluent. (Human waste and some detergents contain phosphorus, which is not completely removed by the sewage treatment process.)

As harmful as nutrients are to aquatic ecosystems, they are also essential for plant growth. In fact, we're depleting the phosphate reserves from mines in Morocco and Florida because the agricultural demand for fertilizer is so high. Some researchers estimate we'll exhaust worldwide reserves in fewer than 100 years.

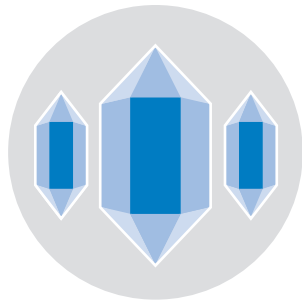
So permit me to crow about good news encapsulated in that vial of crystals. The District is converting the Stickney treatment plant to a biological process that removes phosphorus from the treated wastewater. Ostara Nutrient Recovery Technologies has developed a process to recover this biological phosphorus and turn it into a slow-release mineral fertilizer that the District can sell. Voilà!—waste into resource. Discharged nutrient that causes harm downstream into something that has value. Vicious cycle into virtuous cycle.

Even more exciting is that these phosphorus crystals, which will likely be blended with urea, potash, or other plant nutrients (such as magnesium and sulfur) for sale to farmers, are not water-soluble. So when fertilizer is injected into the soil, it won't run off during rainstorms to cause more nutrient pollution.

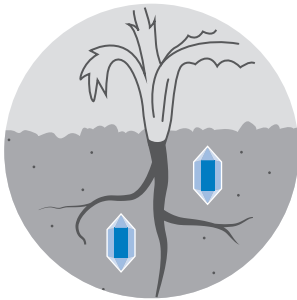




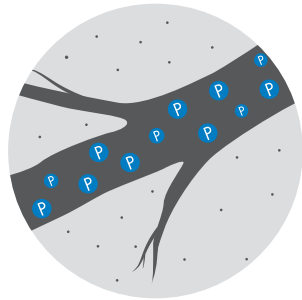
Phosphorus is removed from the wastewater stream...



...and converted into a crystalline slow-release fertilizer that is not water-soluble.



Plants release organic acids that dissolve the crystals to release the phosphorus.



The freshly released phosphorus is absorbed by crops.

Here's how it works: The phosphorus crystals only dissolve in an acidic environment. Plants release organic acids into the soil when they need nutrients, principally during root development and when they set seeds or produce fruit. So plants will take up the phosphorus bound into complexes in the soil when they need it. This also means that fertilizer containing these crystals (called "prills"—aren't you glad you're reading this?!) can be applied to fields and the phosphorus remains available for release throughout the growing cycle.

Ostara may pay the MWRD around \$400 a ton for the phosphorus and early projections are that the Stickney plant may produce 10,000 tons a year. The District is still working out the contract details, but preliminary engineering by Black & Veatch is underway and we plan to be producing phosphorus prills in the fall of 2015.

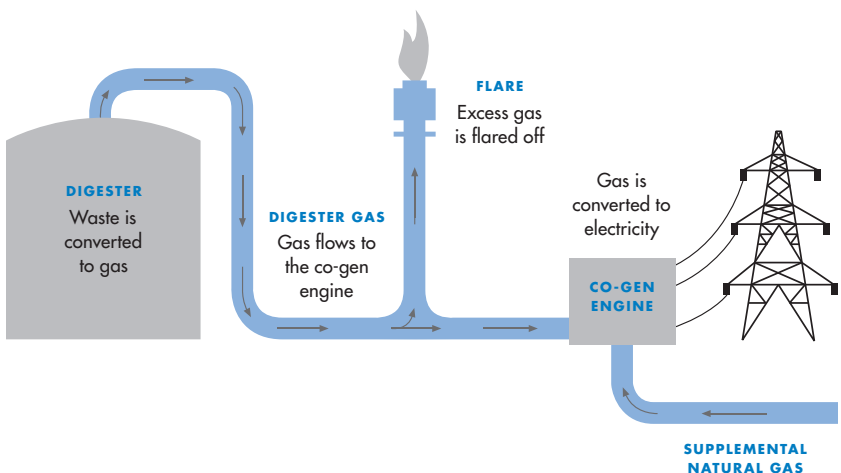
# Resource Recovery & Disinfection

## Biogas

With a little ingenuity and a lot of hard work, the MWRD plans to become energy neutral in just 10 years. What's the secret?

Sewage treatment creates a gaseous byproduct known as "biogas", comprised primarily of methane and carbon dioxide (both potent greenhouse gases). The District currently captures and uses biogas to heat anaerobic digesters and some facilities. But at some times of the year, excess gas is flared off because we do not have the capacity to store it or to convert it into electricity or biofuel. That will soon change.

In Spring 2014, the District plans to award a contract for biogas generation, capture, and reuse at the Calumet Treatment Plant. We know, too, that the plants could produce even more biogas if additional organic material—food waste, fats, oil, and grease—were fed into the anaerobic digesters. Diverting food waste from landfill would save on municipal tipping fees and allow the treatment plants to generate methane much more efficiently than landfills do. Once the Calumet project is underway, the District will issue a Request For Proposals for a similar Biogas Generation and Use project at Stickney, the largest plant. MWRD Executive Director David St. Pierre believes the district can eventually generate 80 megawatts of electrical power from these facilities. In conjunction with other energy-saving innovations, ramping up biogas production will be a cornerstone in the MWRD's pursuit of zero net energy consumption.



WASTEWATER TREATMENT PLANT DIGESTER PROCESS  
COURTESY OF FLUID COMPONENTS INTERNATIONAL LLC

## Deammonification

Wastewater effluent also contains ammonia, a chemical compound partially composed of nitrogen. Like phosphorus, nitrogen is a nutrient that can harm aquatic ecosystems. We've long understood the threat of nitrogen, but removing nitrogen from wastewater was costly and energy-intensive. Until now. The District has launched a test project at the Egan plant in Schaumburg to remove nitrogen using a process called Anitox Deammonification (AMD). In some installations, AMD has reduced energy use by 40 to 60 percent. If successful at Egan, the District will implement this cost-saving measure at other larger treatment plants. Our water environment benefits because we're reducing nutrient pollution; our bottom line benefits because we're cutting energy costs.

Since 2009, through a variety of measures, the MWRD has cut its electricity costs by more than \$17 million, from \$48,422,931 to \$31,107,430 (2013 estimate).

## Disinfection

In June 2011, the Board voted 8-1 to install disinfection technology at the O'Brien Treatment Plant (formerly called the North Side plant) in Skokie and the Calumet Treatment Plant on the far south side of Chicago. Using ultraviolet light (at O'Brien) and chlorination (at Calumet) to kill more bacteria, viruses, or pathogens in treated wastewater, disinfection will improve conditions for recreational users in nearby waterways.

Last September, the District broke ground at both plants to begin construction on the projects, which will be fully operational in time for the 2016 recreational season.

On behalf of the MWRD, I want to thank Governor Pat Quinn, Senators Dick Durbin and Mark Kirk, Congressman Mike Quigley, Chicago Mayor Rahm Emanuel, and so many others for their continued support for disinfection. Their collective efforts will help protect water quality, attract tourism, boost the economy of Illinois, and create 750 construction, operation, and support jobs. Let's row!

# Progress Report

## Last Blast

In 1972, the MWRD embarked on one of the most ambitious engineering projects ever undertaken. The Tunnel and Reservoir Plan (TARP) sought to protect Lake Michigan waters from stormwater overflows containing sewage and to reduce basement flooding by creating a vast network of—you guessed it—tunnels and reservoirs. Part of the plan involved converting a limestone quarry (near the Village of Thornton off I-80) into a vast reservoir to hold stormwater overflows, which would be pumped to the treatment plants when they had capacity to treat the water. Construction on the Thornton Composite Reservoir began in 1998, and since then crews have removed



400-MILLION-YEAR-OLD  
DOLOMITE LIMESTONE



more than 152 billion pounds of 400-million-year-old dolomite limestone. The last blast for mining operations occurred on September 23rd. Upon completion in 2015, the Thornton Reservoir will provide an additional 7.9 billion gallons of storage. That translates to cleaner

waters, drier homes, and \$40 million in flood control benefits every year! Now many of the world's megacities are looking at TARP to model their own urban stormwater management systems.

## Chi-Cal Rivers Fund

Countless studies demonstrate the relationship between healthy landscapes and healthy communities. That's why Chicago Mayor Rahm Emanuel and several private and public partners committed to donating \$2.4 million to the Chi-Cal Rivers Fund over three years. The Fund sets out to improve the vitality and public access of waterways in the Chicago and Calumet region by supporting improvements in green stormwater infrastructure, wildlife habitat, and waterway trail and access point developments. The Fund granted \$1 million in December to enhance green space and reduce runoff at four Chicago Public Schools (Virgil Grissom, Theophilus Schmid, Donald Morrill, and George Leland Elementary Schools), add fish habitat in the Chicago River, and improve natural areas along the Calumet, Little Calumet, Grand Calumet, and Chicago Rivers.

# About Those Carp

## Invasive Species: Should We Restore the Divide?

It's a race against time to keep Asian Carp out of our Great Lakes, but progress has been slow. Preliminary findings from a study by the Army Corps of Engineers suggest that vessels passing through the electric barriers in the Sanitary & Ship Canal near Romeoville could inadvertently transport fish into the lakes. If Asian Carp enter the Great Lakes, it is widely feared they will decimate native fish populations and the sport and commercial fishing economy.

In January 2014, the Army Corps released the Great Lakes and Mississippi River Interbasin Study (GLMRIS) with eight possible solutions to the pressing problem of 13 aquatic nuisance species poised to move in either direction between the Great Lakes watershed and the Mississippi. An extensive study—*Restoring the Natural Divide*—by the Great Lakes Commission and the Great Lakes St. Lawrence Cities Initiative concluded that the best solution to prevent passage of invasive species was to separate the watersheds again. Most people agree, however, that any separation must protect Chicago and the suburbs from flooding, which raises the costs of separation dramatically. No study has included an assessment of the benefits to the Chicagoland region from a massive public works project like separating the watersheds—thousands of jobs, a re-visioning of our transit infrastructure, healthier waterways that attract tourism and industry, and so on. I hope that a genuine cost-benefit analysis can be done. It's been said that all important decisions are made on the basis of insufficient knowledge. That was certainly true when Chicagoans decided to reverse the river 125 years ago. It may well be true today.



HISTORIC RIVER FLOW CIRCA 1900 AND TODAY'S FLOW, POST REVERSAL  
COURTESY OF THE GREAT LAKES COMMISSION

## A Great Honor

It came as a huge surprise (albeit a very, very pleasant one) when I learned the Water Environment Federation (WEF) selected me as the recipient of their 2013 Public Officials Award. The WEF is an international organization representing 36,000 members and 75 affiliated Member Associations in water and wastewater management.



Reflecting on my two terms as a Commissioner of the MWRD, I'm proud of all that we accomplished: expanding the green infrastructure program; saving taxpayer money by opening contracts to competition; participating in a pharmaceutical collection program; installing disinfection systems at the O'Brien and Calumet plants; and now championing nutrient recovery and passing the Watershed Management Ordinance. But these victories have not blinded me to work still looming on the horizon.

We must enhance the resiliency of our water and wastewater infrastructure. We must take a firm, multi-pronged approach to both mitigate and adapt to climate change. We must prevent invasive species from entering the Great Lakes. We must protect our drinking water from emerging contaminants like pharmaceuticals, chromium, and microplastics. And we must never cease striving to protect all residents from flooded homes, businesses, and neighborhoods. I thank WEF for this great honor and accept it not as testament to what I've already done, but as a call to stronger, faster, and bolder action in the future.

## Fascinating Facts

# 44

ILLINOIS COUNTIES DECLARED  
DISASTER AREAS BY GOVERNOR  
QUINN AS A RESULT OF THE  
APRIL STORM

# 2,000

GALLONS CONTAINED IN  
1 INCH OF RAINFALL ON  
A 25'x125' CHICAGO LOT

# 62,300

RESIDENTS APPROVED FOR FEMA  
FUNDS IN QUALIFYING ILLINOIS  
COUNTIES, INCLUDING COOK,  
BY LATE DECEMBER 2013

# 5.8'

THE MINOR DROP IN ELEVATION  
OVER 28 MILES OF SANITARY &  
SHIP CANAL, FROM THE SOUTH  
BRANCH TO THE DES PLAINES  
RIVER. IT'S NEARLY FLAT!

### PHOSPHORUS CONTENT OF COMMON FOODS

1 can Coke	39 mg
1 oz cheddar cheese	262 mg
1 tsp baking powder	446 mg

Phosphorus a person  
contributes in human  
waste to sewage  
plants every year

# 1-2 lbs



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## 2013 Annual Report

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Cover photo by Robert Kusel