

“Lessons We Learned from Hurricane Irma  
September 2017  
FW&PCOA  
Kevin Shropshire  
Director, Region 3

At the Region 3 October meeting, we spent a good amount of time discussing the recent weather and its effects on our utilities. To help us move forward for the next storm(s), please consider completing this survey. It can be anonymous, or not. Please include as much information as you'd like. This is for our informational purposes only.

Thank you  
Kevin Shropshire  
Director, Region 3, FW&PCOA”

... That was the email sent out shortly after Hurricane Irma (and the lovely accompanying storms) hit Florida.

I received 22 responses almost immediately. Thank you.

I then removed the requirement to go find your password & log into the website, re-emailed everyone, and watched the survey results hit 60 within a week.

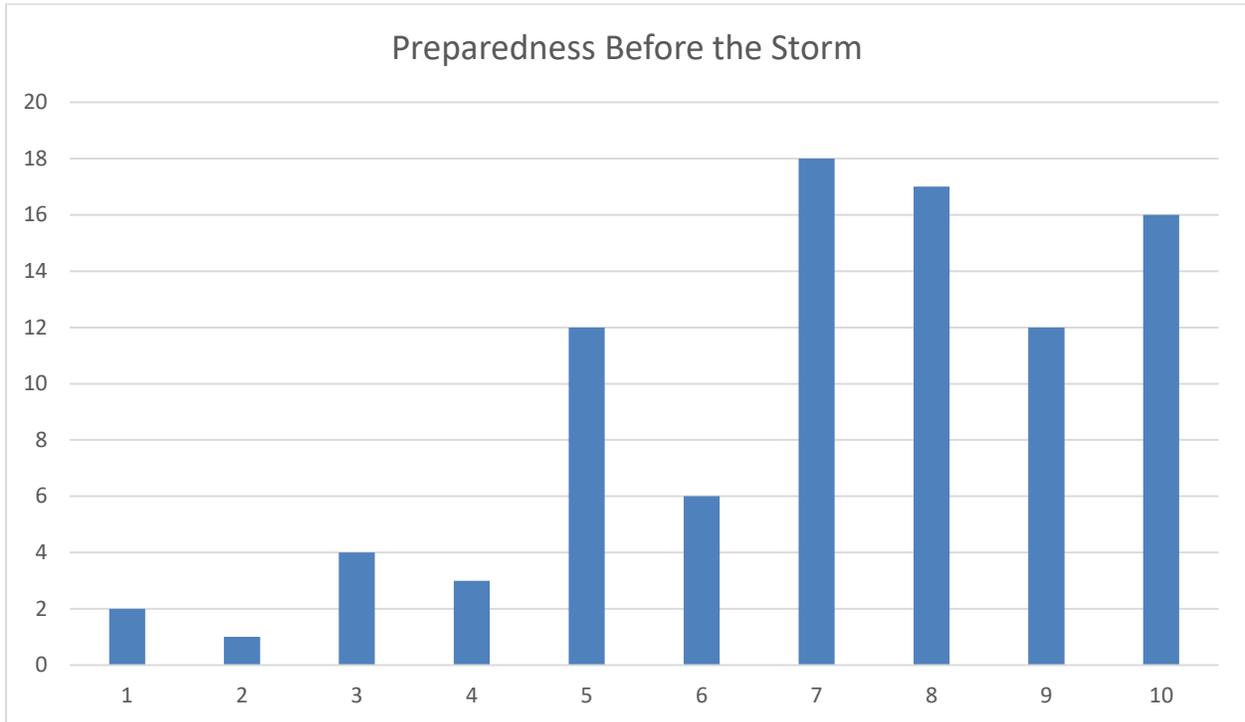
The survey was continued, at the request of the FW&PCOA President, until today, 12/5/17. At the close of the survey, we have received 91 survey responses.

Thank you very much.



1. On a scale of "1" (What's a Hurricane and where did all that water come from), to "10" (No problem-o, we've got this blind-folded), how do you feel your utility prepared for Hurricane Irma & the ensuing 3 weeks (and counting) of rain?

Responses    91      Hi    10      Low    1      Average    7.19



Preparedness Comments:

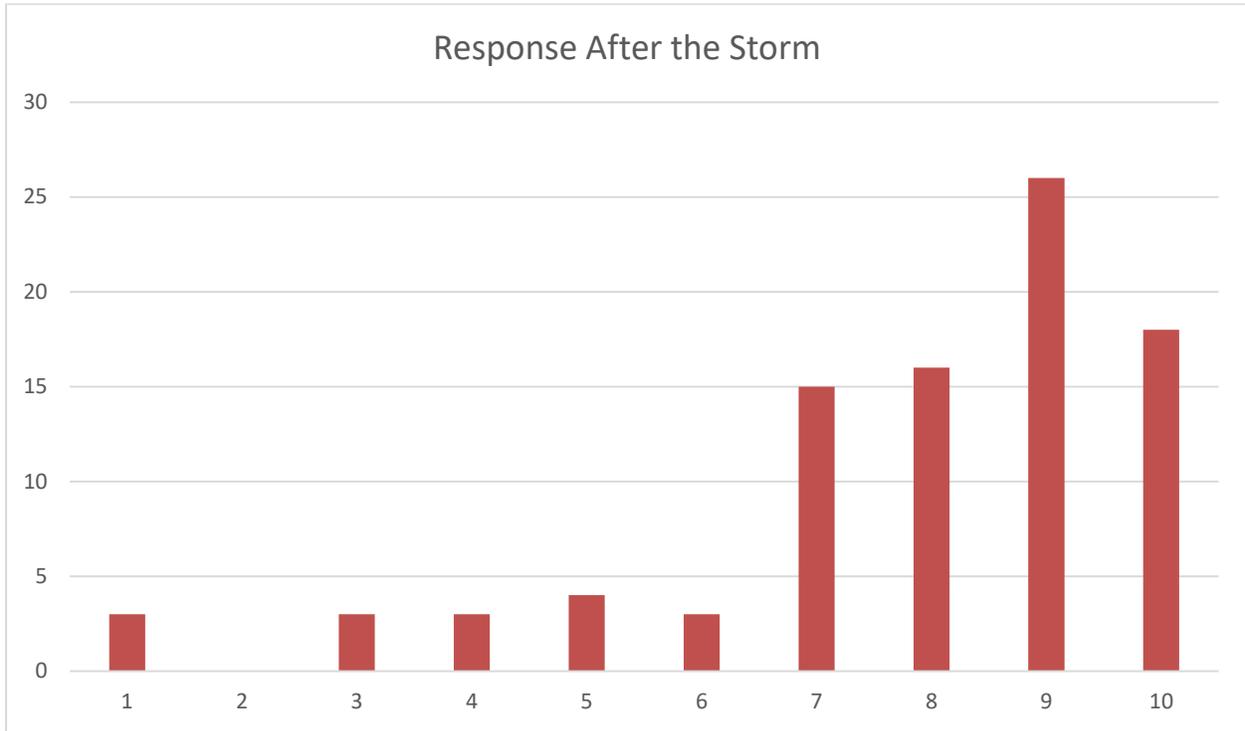
- Lack of communication from management and did not stay with emergency plans
- Hurricane Procedure needs revision & review with all WW employees.
- seemed to be very well prepared
- Not a clue!
- In Orange County we had dry runs to ensure all our pump stations could be monitored using generators. It helped tremendously and all employees benefited from the exercises. It made for a smooth operation during the hurricane
- A lot is learned from actually going through the storm.
- I think we prepared as much as we could. Our fuel and chemicals were fully stocked. We prepositioned portable generators at critical lift stations that did not have permanent generators. We also made sure staff was positioned at each of the water treatment plants and at the Water Reclamation Facility in order to be ready to respond to any possible problems throughout and immediately following the storm.
- The written wastewater SOP needs revision, but all WW employees knew their role.
- lots of rain but it could have been much worse the utility was prepared and came through pretty good
- Our utility was prepared. After experiencing hurricane Charlie we knew what to expect.
- We have an I&I issue that has been growing over the past 25 years and have yet to address it in a mindful way.
- We did the normal routine, cleaning the site, stockpiling pumps, generators & food, but how well can you really prepare?
- I thought we were well prepared. Everyone buttoned up and canals were lowered. All in all job well done.
- "We had no issues at the WTP's, we were prepared.
- The one issue we did not see what the amount of rain (12'+) that flooded the woods roads and with the rain water and the washed out woods roads, some of our wells were not accessible for days. "
- Utilities Department and Stormwater Department handled getting prepared for the storm very well. All crews were out cleaning storm drains and high areas that flood.
- The fact that the water table is the highest it has been in 10 years accounts for the extreme I&I issues. treating rain water is expensive and more should be done to repair aged sewer lines
- My director was good about making sure all operators knew where to find the SOP for high flows and we prepared by having all valves and operations set correctly for the high flows and ensured that we monitored the plant as needed.
- Fueling vehicles, generators and staging equipment was our preparation.
- They prepared fine. They had crews out cutting or trimming trees. Saw crews by lift stations with generators.
- Hind sight is golden but you do learn where some of your weaknesses are post storm.
- The Chief Operator and Superintendent were proactive and prepared for worst case scenario, i.e. ordering chemicals needed in anticipation, scheduling essential personnel during peak times. This was accomplished with a third of the plant off-line.
- For us this was not much of a flood event. Power Outages were the main problem with this storm along with debris removal

Preparedness Comments (continued):

- We are a very small system, there only so much available to spend. It's hard to determine the actual effect of the storm. To rent bypass pumps or generators for all lift stations and purchase numerous fittings and valve that 'may' be needed is difficult
- Utility Operations had prepared fairly well overall and sis a good job.... However, interdepartmental communications and planning need improvements to interact with all departments resolve issue and communicate external issues.
- More generators were needed to keep lift stations on line. The crews did a great job but having permanent generators at some of the key stations would have made it easier for the guys who were towing mobile power supplies from station to station trying to keep up with the demand, as the power was out for up to five days. Also better communication and organization was needed to direct the response teams, ' strike force ' teams as they were called. People were on hand but not the right ones who had the knowledge, equipment and materials to repair water leaks, i.e. backflow testers were on hand but waterline repair crews were in demand.
- Not enough generators for lift stations without power
- Many stages of preparation are taken ahead of impact.
- Through various training sessions, staff and personnel at the Pinellas County Utilities - South Cross Bayou Advanced Water Reclamation Facility were preparing for the hurricane season ahead of time (prior to the commencement of the season).
- Not enough pumps and generators. Those on hand not properly maintained
- We had very little problems getting prepared
- I feel that the shelters housing the field workers were okay, but we need to have a place just for our county workers, their family and pets. If the workers feel their families are taken care of, they are in a much better frame of mind.
- almost no storm surge average at high tide
- "We have 8 ground storage tanks for fire pumps. These tanks range from 500,000 to 1 million gallons of water. We were able to run our cooling towers and provide water for Porto let operations from these tanks."
- We prepared the best we could with the time we had
- Flooding from the ICW was unexpected. I mean we had flooding before but not this bad in the 30 years I have been here.
- We prepared the best we could with the time we had
- Drinking water side was prepared. Only 4 line breaks associated with storm damage repaired within 24 hours after storm left. Ran some of the disinfection booster stations, pumps and water storage tanks in the water distribution system for almost a week on generators. Sanitary sewer treatment plants were prepared and ran on generators however problem with no power to lift station and not enough generators. Several SSO resulted.
- We work at a drinking water plant
- The Seacoast written preparation plan is geared for the worst, we got lucky on this one with little damage.

2. On a scale of "1" (What's a Hurricane and where did all that water come from), to "10" (No problem-o, we've got this blind-folded), how do you feel your utility responded to the effects of Hurricane Irma & the ensuing 3 weeks (and counting) of rain?

Responses    91      Hi    10      Low    1      Average    7.79



Response after the Storm Comments:

- Lack of adequate number of portable generators or bypass pumps.
- We had one minor sewage overflow. We had an over a half million gallon capacity in backup storage and we used it due to 160,000 gallons of infiltration and inflow.
- not much rain, should have trimmed trees and picked up loose debris
- We are giving many of our personnel to assist road and bridge to clean up all the debris. This severely handicaps our daily job functions.
- We ironed out any problems we came across in the hurricane, with little effort
- The implementation of staff phase designations was effective. Establishment of a dispatch station was also very helpful in dispatching personnel to various pump stations along with providing communication devices, food bags and, vehicles.
- Crew members are proud and determined to bring systems back to normal.
- Not enough generators for lift stations without power
- "With the people and materials available, our utility did a tremendous job, with very little noticeable impact to our customers. Upper management could have done more over the past decade or so in ensuring we had things like generators and by-pass pumps and a practiced situational chain of command. There are three levels of responders in a situation like this for us and at the last minute management sees who's available and sends them out. I'm not sure how information is received and level of importance is determined."
- We did very well in response. If the storm was a Cat 3 or larger it would be a lower score.
- Staff all responded and completed all tasks at hand. We did not deal with flooding conditions. We had all resources needed on hand and we continue to do so.
- Between our own crews and help from the Warn system I'm not sure it could have been done any faster or better.
- The crews responded by placing cones and/or tape around small flooded areas for safety until the water would recede. Lots of trees were down so crews were working to make roadways safe by cutting up the trees.
- Flooding was not an issue. The volume of tree debris was a bit overwhelming. Our staff has about one more week of cleanup.
- We continued to follow out SOP for high flows as the high flows continued well after the rain stopped. All operators were aware of the process to follow for high flows to ensure no loss of solids.
- eliminate infiltration
- Our Department worked hard to access our areas to determine damage and to make sure water was working for our customers.
- No Problem.
- Next day we were out and about clearing debris from the road and picking up any loose items. Checked for damage and reported all findings.
- Excessive rain really exploits I/I points, especially when the rain persists for multiple days that is our biggest challenge.
- We were pretty much on our own
- The rain was not much of an issue; we had generators to assist with lift stations without power.
- WW crews worked tirelessly & without complaint to manage ~50 lift stations without power.

Response after the Storm Comments (continued):

- I feel that considering the circumstances we responded very well. Three of the 4 treatment plants ran off of generators for almost a week. When the storm initially ended 69 of the City's 73 lift stations were without power. SSOs did occur as a result of the widespread power outages. We did not have enough portable generators or staff to pump them all down immediately. Four water main breaks also occurred as a result of the storm. Utility staff worked 24/7 for several days following the storm.
- MAGNIFICENT. IT IS SO COMFORTING TO KNOW WE HAVE COMPETENT CREWS WORKING DAY AND NIGHT FOR US.
- Only two of us, out of 12, that had a clue so we had to tote the load for everyone else even though everyone got equal credit for our plant not experiencing an overflow. We are still experiencing operator errors!
- everything seemed to work out well
- Field employees worked without question to 'juggle' generators, portable pumps & non-functional lift stations.
- We only had Cat 1 winds and minimal rain in last three weeks. We repaired water mains in 2 days and had a lack of generators for pump stations, lots of SSO's
- We prepared the best we could with the time we had
- Team work among the utility crews was notable, doing whatever was needed to get the work done.
- The worst was the power failure at about 50 lift stations which was easily handled with our generators and field personnel.

3. Did you lose power?

a. In the comments, you can include % of utility or days. – 35 Response Comments

Responses    91      Yes:    80      88%      No:    11      12%

Loss of Power Comments:

- Plants ran on generators for a few days, pump stations were out for as long as 7 days
- Main raw water pumping station for 3 days, 59 of 154 lift stations for 1 - 5 days.
- Retail LS
- 3 days at WWTP. 90% of lift stations initially.
- lost fpl power, but had backup generators ( of course )
- 4 days
- 7 days on generator which was no problem operationally as our generator is large enough and had ample fuel.
- Went on Generator before loss as a precaution
- One
- had to control the pump stations with generators, some two days others up to 5 days
- 50%
- Overall after the storm I would say that about 90% of the utility was without power. Two of the three water treatment plants and the water reclamation facility were without power for 6-7 days. 69 of the 73 lift stations were without power immediately following the storm. By Friday about 20 lift stations still did not have power. The treatment facilities and master lift stations ran on permanent on site generators for the duration of the time they were without power.
- 90% of lift stations. WWTP switched over to generator prior to complete power loss, power not restored for 3 days.
- 4
- "three W plants without power lasting 3-5 days"
- 85% of city without power, all water plants and wastewater plant was without power.
- Generator failed when the power line surged and failed. We went down at 2200 and were back up at 0715 when the operator made it on site with the storm moving north but not 100% safe.
- Out before the 'real' first responders.
- Most lift stations lost power and ability to pump
- 50% of our 105 lift stations lost power. FPL was great; everything was back on within 7 days.
- At the water planet we did not lose power but ran on generator to avoid the power bumps. Switched back to FPL day after storm.
- 13 hours
- 3 days
- It took five days to restore power. A branch from a huge tree near I-95 was down and had cut the line. It took crews awhile to access the tree to clean and work on the repair.
- we started our generator at 1900 after 2 power glitches, ran continuous for 20 hours
- Three days after storm 20% of lift stations that lost power did not have permanent back up power and required staff to juggle portable generators between stations. Five days after storm number dropped to 5% of lift stations requiring portable generators.
- 2 & 1/2 days on generator

Loss of Power Comments (continued):

- we were on backup generator
- We were on generator power at one wastewater treatment plant for five days. It seems that Duke Energy was more concerned with restoring residential power than critical facilities.
- Generator Lost power Sunday afternoon, got it back Monday night at 10pm. Crews were out in force putting on power but a couple of areas were without power until Wednesday or Thursday.
- 100% for 4-5 days.
- Backup generators at treatment plants functioned properly.
- About five (5) days.
- did not lose power at PGA plant PBG, Florida
- Hillsborough County out for 4 days power line was take down from trees, My Take is not enough is done on keeping the trees cut back from the power lines.
- 4 out of 15 sewer lift stations. Town Hall and PD lost power but had stand by generator that ran for a week straight
- Sporadic power outages but nothing permanent
- Backup power was on at Reclaimed water treatment plant and at 3 of four water treatment plants. All power was operational. Lift stations had power outages as well some had backups, most did not.
- At my personal residence power was out for five days. As near as I know none of the utility's buildings were without power as they all had backup generators and were high priority for the power company to get on line.
- One week.
- 7 days without power
- Power was lost for 12 hours
- 65 out of 144 were temporarily left with no power.
- "At home yes. Power bumps at the plant. Question could use some clarity"
- Only one generator failed, but many were called upon.
- I lost power at my home for 3.5 days. I had a generator hooked up to a window unit AC and also running 4 other appliances.
- generator power worked good had a higher quantity of water made, did not need to run during storm, able to go back on generator power after power returned to help the power grid
- We lost FPL power but had backup generators for 90% of our system.
- 75%
- Only 6 hrs. Here at the plant. The lift stations lost power for 3-4 days.
- 3 days
- Wouldn't know if we lost power because we switched to generator power right before the storm
- 5
- Depended on generators at some location for almost a week.
- We were without power for 8 days
- 100% Utility Power Lost. Backup Generators and Portable Pumps Functioned Well
- Lost power at water and wastewater plants for a several hours, at 3 raw water repump stations for 2 - 3 days and at 50 wastewater lift stations from 1 to 12 days.

4. Did you lose (potable) water?

- a. Mostly directed to utilities that obtain their potable water from another utility. In the comments, indicate how many days. – 27 Response Comments

Responses      91      Yes:   12      13%      No:    79      87%

Loss of Potable Water Comments:

- Very close, 9 water main breaks and lost a lot of stored water until valved off.
- Precautionary Boil Water, isolated
- 2 days Pasco county
- Only 2 service line breaks
- BUT VERY BRIEFLY
- The City's water treatment plants continued to produce potable water throughout and after the storm.
- Loss of pressure for 1 day.
- Water was shutdown to prevent loss due to breaks
- All of our water plants are equipped with generators.
- We have stand-by generators at all water production facilities and a fantastic Distribution staff.
- We were good here at the WTP. No issues with producing water for the residents.
- on a well
- Deltona never loses potable water
- I'm not 100% sure if we lost potable water...
- Never lost water or even a boil water order.
- No water main breaks or boil water notices
- Backup power (Generators) were in place
- Luckily system pressure was maintained with one of the 4 water treatment plants operational. Also our three Evaluated storage tanks helped maintain water distribution system pressure. :)
- The water operators did an outstanding job of preparing for and maintaining potable water for our customers. Other than a few up-rooted trees damaging small sections of water lines, which were quickly repaired, no one lost water and Cl2 residual remained at near normal levels. The main reason for any decline was due to lack of demand from those who evacuated.
- City of Palm Bay did not need to issue boil water alerts. But shelter was using City of Cocoa water and did lose potable water
- Due to the failed generator, one subdivision lost potable water
- we lost water for two days
- We have our own water supply.
- Wouldn't know since we were at the water plant
- Only 4 line breaks associated with storm damage, repaired within 24 hours after storm left. Maintained water pressure throughout the water distribution system at all times and completed initial water quality monitoring and bacteriological sampling by the next day after the storm event.
- Came very close the day after with all the backflows leaking

5. Drinking Water/Distribution Folks: What are some lessons you or your utility learned from Hurricane Irma & the ensuing 3 weeks (and counting) of rain?

Responses 41

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Drinking Water/Distribution Lessons Learned:

- Do not plant trees over water mains
- Fill your storage tanks for use and provide pump ports to use after the storm. Empty all backup sewage tanks for storage during and after the storm. Stay vigilant on I&I reduction.
- protect above ground installation located isolation valves
- I did not notice any issues with the drinking water.
- You can accomplish more, when all departments work together.
- Making sure you have spare parts on site and not in some distributor's warehouse.
- The next time something like this happens we should do things the same. I am very pleased with the water system and how well the operators and monitors prepared for and responded to a potential major health crisis.
- Fill water storage tanks to float system. In case Back up power generators or controls fail. We did not get the amount of rain as the east coast did.
- Never assume any storm small or large cannot affect you. All can.
- "If they want us to stage at a plant, that plant should be better equipped. Beds, food, internet connectivity, etc. In my opinion, I don't agree with sending us out to stage. We should be home taking care of family. I also think they should revisit how the disaster pay is handled. I will be surprised if anyone in our group will volunteer again."
- We were very fortunate. Could have used a couple more chainsaws.
- Being ready for a storm in general anytime of the year in Florida is the best practice. Pinellas County
- We learned and have practice since the hurricanes of 2004. To put our water plants on generator power one at a time before we lose power. To make sure everything is good and no problems. If there is we have time to take care of it and our system stays up and running.
- The City of Cape Coral kicked Irma's ass.
- Biggest problem was service lines many on the customers side. These numbered in the thousands so it in effect made our system into an open pipe causing the inability to get any pressure into the system.
- I can't answer this, I am retired.
- "Most of the water loss was caused by service lines uprooted by fallen trees. Need to better survey the location of any object that could be blown over or uprooted and damage mains and service lines. Florida Keys Aqueduct Authority."
- Our potable water system was not affected.
- We lost power for about 6-7 days at the plants. We were operating on generator. We are very grateful to our diesel supplier who came as often as every three to four days to refill the generators. On day 5 the generator at our main office (housing our telephone system and radios) and water plant broke. One of our staff members went to Miami to get the part, and we had it back on that day. We were very grateful to have LCEC instead of FPL.

Drinking Water/Distribution Lessons Learned (continued):

- "Part of our crew was able to help in the restoration of the Florida Keys AA to restore water from the Upper keys to Marathon for 3 weeks.
- Our area was not hit with any water issues so we were able to focus our help to other areas of Florida."
- Preparation is the key.
- It was not a matter of learning from hurricane Irma because we knew what to expect. It was a matter of being prepared for it and us to that into account and prepared.
- store- up fresh water for drinking
- We had 4 main breaks occur as a result of the hurricane. We are small Utility and do not have a lot of staff. We learned that we should bring people in as shifts and not bring them all in right away hoping to get everything fixed up immediately. Due to IT issues we also didn't have access to our maps. So we learned that we need to get a backup setup in order to be able to view our distribution maps at all times. We also learned to prioritize problems as they came in.
- More generators are needed
- Good maps of system are vital
- locate isolation valves
- Need outreach for PBW to customers
- We went through Mathew Last year so I feel the improvements we made prepared us for Irma. We lost power with Mathew and the Intracoastal came up to levels higher than they ever have. Salt water got in our generator so we couldn't operate. Also some of our high service pumps got saltwater in them. We repaired generator and lifted it up at least 2' higher and also raised our high service pumps.
- Not my dept.
- TO KEEP PLENTY OF FUEL ON HAND
- Evacuations of residents in certain parts of the water distribution system like the beach communities caused the water usage to go way down. This resulted in the need to increase flushing activities and volumes to keep the water moving and maintain disinfection residuals until the power was restored and people returned to use the water again.
- Our bosses don't care about our safety, we were called out way to early. The wind gusts were way higher than what we were told we would be called in,
- CLEAR TREES FROM POWER LINE TO ENSURE A SPEEDY FIX TO GET THE POWER BACK ON.
- Getting gasoline and diesel was a challenge
- Plan for refueling portable/backup equipment needs to be updated. Cannot rely on State or local Emergency Management.
- "We needed a proper staging / home base command building for workers and their families, instead of running to a school / shelter at the last minute that just so happened to have enough room to take us in.
- And steeper penalties for those who didn't show up for work would be nice."
- No issues, we didn't receive much here in NW Fl. But we have dealt with our fair share and began preparations well in advance in case this storm would have affected us.
- we work well under pressure.

Drinking Water/Distribution Lessons Learned (continued):

- Evacuation and communication present some challenging obstacles to work on for future events.
- need better tree trimming

6. Stormwater Folks: What are some lessons you or your utility learned from Hurricane Irma & the ensuing 3 weeks (and counting) of rain?

Responses 12

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Stormwater Lessons Learned

- Same as above but add use of SCADA system to monitor LS and water pressure.
- clear catch basin way before
- Clean inlets, channels and basins before storm. Open slues gate in storm channel damage to prevent further flooding pre storm.
- Infiltration is something that needs to be address
- I can't answer this I am retired
- It was critical that we removed the debris from areas with stormwater infrastructure quickly in order to keep the drainage system clear and avoid flooding conditions.
- Stormwater had lots of debris that had to be removed. Our crews worked with Public Works and other companies to remove trees and debris.
- We done fine.
- You can never be too prepared. Hurricanes cause debris to clog drainage areas and you must be in a position to respond quickly.
- "Keep drains open
- Track tide tables for re-occurring coastal flooding (take in consideration rime shift to your location"
- clear potential debris
- Not my dept.

7. Wastewater (Collection) Folks: What are some lessons you or your utility learned from Hurricane Irma & the ensuing 3 weeks (and counting) of rain?

Responses 35

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Wastewater Collection Lessons Learned:

- Need more generators for pump stations and need to do more lining of gravity mains and laterals
- It would be nice to have power when water is turned on. (just saying)
- set up auxiliary pumps and power
- Again we need a county shelter only for the employees and their families. We also need more backup generators to run the pump stations that loose power. The biggest issue with wastewater was the power outages at our pump stations. This causes the county to change shifts and pay overtime to the employees. Both of these cause a big blow to the county funds and customer service.
- Insufficient generators of both the portable and fixed types. Many lift stations without power were over-whelmed in between pump-down and power restoration.
- Get more Generators and Bypass pumps. Overall or system and collections did well, with only one S.S.O.
- "Locating and having pumps set up on critical sewer pump stations and enough generators to work the power outages,
- if the storm were a Cat 4 or 5 the result's would have been significant (maintenance side)"
- Prepare, prepare, prepare, and have personnel in place. Here, we had besides the operators; we also had electrician and maintenance personnel on sight during the storm.
- Can't answer this question, I am retired.
- "Location/height of control panels to eliminate effects of tidal surge. More portable generators.
- FKAA"
- The power was out for several hours before it was safe enough to go in the field and evaluate the lift stations. The systems was overloaded and once all lift station were pumping at the same time it overloaded the treatment plant which caused it to go out of compliance with high TSS.
- We finally got power to all of the lift Stations 10 days after the storm. Before that we were using portable generators. We definitely need more generators, and a way to store more diesel.
- we demonstrated a need for more permanent as well as portable generators
- Need more generators on hand for back-up purposes.
- You can never do too much to eliminate I/I. Don't forget about this issue during the dry months; take advantage of the lower groundwater table.
- Put in the capitol budget for a few more generators to assist with power outages.
- Manage your rest breaks better.
- none
- We need to install more permanent generators at lift stations throughout the collection system. We also need to purchase several more portable generators and another Thompson pump. We had a few lift stations that had generator or pump failures so putting a permanent generator at every lift station is not necessarily the solution to all of the problems. We could also use more staff to help pump down and rotate portable generators. Our 4 lift station staff members did not sleep for days. We will have to do more cross training in the future.

Wastewater Collection Lessons Learned (continued):

- "Preparation and dry runs are essential and should be administered periodically to ensure that all staff is properly trained. To include all old and new employees.
- Be prepared to work in harsh conditions and know the public needs our assistance during these times."
- You can never have too many generators. Residents need to be educated about the effects of flooding to the sewer system and how they can help reduce the impact to the lift stations and plants.
- The need for better communication with the power company and more generators.
- Have a plan to rotate your generators. Don't pump to a surcharged system without power.
- have portable power and pumps some for private use complexes
- Need for Infiltration assessment. More public education about where the sewer goes in times of power outage.
- Need additional portable generator mechanics
- Carefully cultivate positive working relationships ahead of time with first responders. Police can be exceptionally helpful in navigating the streets when trees are down, traffic signals are out, and utility vehicles need to mobilize and connect portable generators.
- Once again no problems with collection system we bought extra generators to run lift stations before Mathew. So we had generators and fuel ready to go.
- Been thru this before so nothing new here.
- Learned that the excess water from rain affected our plant process and daily operations
- That no matter how many generators or preparations you make, there is always the variable that will slow recovery
- same as above fuel
- Plan for refueling portable/backup equipment needs to be updated. Cannot rely on State or local Emergency Management. Also learned of major inflow into sanitary sewer system
- Same as above
- We found weaknesses in instrumentation and control due to rain and wind.

8. Wastewater (Operations) Folks: What are some lessons you or your utility learned from Hurricane Irma & the ensuing 3 weeks (and counting) of rain?

Responses      44

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Wastewater Operations Lessons Learned:

- teamwork made thing work more smoothly
- make room
- Kind of doubt anyone learned anything as there are only two of us whom give a damn! Although confirmations of incompetence were once again verified.
- Be ready for all the cleanouts that residents WILL open.
- Having SCADA department onsite helped with potential problems
- To review and revise the hurricane manual.
- There was not much we could do as far as the high incoming flows go. We tried to treat as much of it as possible. I am not sure what we could do to rectify this. We did have some equipment failure from overuse. We need to continue to replace equipment as stated in our capital plan in a timely fashion.
- "Cell phones are not good substitutes for radios.
- All approved FEMA forms need to be distributed before the storm."
- none
- Influent spikes at the WWTP equals citizens opening manholes in neighborhoods.
- The wastewater plant had some issues that were manageable but out of our ability to control. Some operations had to be run in hand due to the power surges damaging some pumps.
- Head works and final filters were/are choke points
- That following ANYTIME sewage backs up it is hard for the plant to treat that surge of flow.
- We are still treating storm water and Brevard County Utilities is only worried about paperwork for FEMA
- better communication to FPL on power account numbers and meter numbers is needed the FPL system showed power but only 110 power not 3 phase power
- Due to power losses, flows did not increase right away due to lift stations being out. operational challenges continued for approx. 1 week after the storm due to continued high flows as stations came back on line
- A wet weather discharge site incorporated into our reclaimed water system would have allowed us to lower storage tanks prior to storm more effectively- providing more storage space during high flow periods during and after storm event.
- Had a bypass pump installed and piped to our reject tank, this gave us an above average but steady flow into the plant. Reject tank will be slowly drained once flows return to normal.
- We finally got power to our WWTP on day 6 after the hurricane. We are very grateful to our diesel supplier. One of the generators had to be refilled every day.
- The importance of how to operate the plant during high flows and loss of power situations. I got very familiar with the SOP for high flows and I now have a better understanding of how to control what we can during the storms and how to ensure we can avoid loss of solids and spills.
- See above.
- "Treatment facilities faired OK, but reinforced handrails would have been nice. FKA"

Wastewater Operations Lessons Learned (continued):

- Solids inventory needed to be higher at the time of the hurricane
- I can't answer this question, I am retired.
- See the above.
- Even though you tests run equipment either daily or quarterly, still can have a malfunction in a storm, PGA WWTP
- I think that having generators would have worked better for us that by pass pumps. There was unusual high pressures in the force mains and the smaller by pass pumps could not overcome the pressure whereas the electrical pumps were able to
- High-flows operations SOP should be planned out and documented and reviewed with operators. This was done a week before the storm which really help our when max flow was 7 MGD over rated peak flow. Review each phase of treatment to for Peak flow and have all treatment units and pumps operational.
- Better preparation is needed before storm.
- Back-up generators were not as reliable as they should have been. Extended use and heavy loads showed vulnerabilities. As quickly as F.P. & L. could not restore power, this was a major concern.
- Preparation prior to hurricane season (e.g. planning staff rotations, preparing maps and having lists of staff of appropriate evacuation zones, establishing a dispatch station, cross-training) was critical.
- More Equipment. Better Maintenance.
- Little things need attention too. Because of inadequate Pest Maintenance, chlorine feed pumps were tripping circuit breakers due to high water around the electrical conduit drove ants up into the junction box which caused the shutdown. Cleanup and removal of the ants fixed this problem.
- NA I would add we have an expectation of selfless employees and in many cases I saw people with damage to their homes come to work and help as if they had no problem. We as an industry need to understand and reward such behavior.
- Some of the younger employees did not take the threat serious until after the storm made landfall.
- No problem at wastewater plant with Mathew or Irma other than loss of power. Generator ran great.
- Same as above. Been thru this before so nothing new here.
- I know didn't like being called to duty first thing in the morning. Very hazardous conditions, especially in the dark.
- Learned that the excess water from rain affected our plant process and daily operations
- I was on maternity leave when Irma hit our plant. I was not here for the aftermath and all I know is that my lab was flooded and has not been fixed yet.
- fuel
- We learned the need for reduced solids inventory in the plant. Sustained hydraulic flows were a problem.
- Rooftop powered ventilation hoods need better anchorage.
- tree limbs, palm branches, and other airborne debris from nearby trees and shrubs landing in final tanks caused some small problems with our equipment. lesson learned : need to trim back all trees and palms prior to hurricane season to prevent.

Afterword:

Thank you all for taking the time to help us learn from these events.

Please feel free to utilize this information in your Hurricane Procedures, training materials, etc. etc.

Thank you all for your participation,

Kevin Shropshire

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