**Sea Level Rise Subcommittee Meeting**

**Subcommittee of Town of Kiawah Island Environmental Committee**

**Town Meeting Hall**

**October 16, 2017**

**Minutes**

**Persons attending meeting**

John Leffler, Subcommittee Chairman Diana Mezzanotte, Town Council Member

Bob Cheney Jim Chitwood Will Connor (KICA) David Elliott

Jane Ellis Matt Hill (KICA) Jim Jordan (TOKI) Jack Kotz

David Pumphrey Lyn Schroeder

Members Absent: Bruce Spicher

**Report Writing and Types of Flooding**

Mr. Leffler outlined two causes of flooding: 1) precipitation and 2) high water flooding caused by King Tides and/or storm surges. Precipitation flooding comes from rain water over topping the drainage system like the October, 2015 storm. Tidal or storm surge flooding arrives quickly in large volumes. It is unlikely the drainage system can be effective in managing high water flooding, particularly storm surge because large volumes of water flow so fast. Committee members considered that these events might occur in any combination including a worst case combination of substantial rain fall coupled with a storm surge arriving at high tide

Mr. Pumphery suggested the report describe the storm water system, how it should work, then consider how each different flooding event might impact the system.

Mr. Leffler noted the introduction should cover the “significance section” which is flooding caused by precipitation and/or tidal and storm surge. The “status section” might describe the current system and how it works. Then the report can consider the three or more types of flooding events that might occur.

Mr. Chitwood suggested we address pond infrastructure, its current condition, how to maintain it, and address the short-term functionality of the system. He emphasized the importance of drainage infrastructure expenditures focusing on designs which modify and update the system rather simply repairing the existing system.

**The Drainage System**

Mr. Connor described Kiawah’s drainage system.

The drainage system is twice the size required. Detention ponds must equal 10% of the project area (homes, not open space.) Computer modeling was not widely used when the drainage system was designed, so engineers created a system for what they *thought* might happen. Then, they made the system bigger than required in order to compensate for any errors.

Drainage systems are required to absorb 6 inches of rainwater every 24 hours. Design specifications also detail a drainage system’s ability to manage water from 10, 50 and 100 year storms.

Kiawah Island’s drainage system is an open ended flow which operates on head pressure (or gravity); water can flow into or out of the drainage system. Water can flow into the system at high tides or storm surges when head pressure outside the system is greater than pressure within the system. Since all the system pipes are submerged, there are times when the outflow pipes are completely submerged by tide water. At this point, water flows inland. Since most of the ponds are interconnected, high tides can flush water inland if the gates are open.

Opening and closing manually operated gates restricts flow in or out. Mr. Hill noted the gates get covered with marine growth and collect trash. These problems cause the gates to deteriorate and can diminish their effectiveness. Mr. Connors suggested that froth and bubbles surrounding some outfall/gate areas indicate some gates may be undersized. Mr. Hill noted that we have gates valves and flap valves. Exterior flap gates can be left partially open for water transition.

Flow throughout the system is also impacted by the size, material and condition of the pipes. Flow can be restricted by smaller pipes, corrugated pipes, clogs created by pine straw, yard debris or sediment, distance from the outfall, and deteriorated pipe walls. Fast flowing water tends to keep pipes clear of sediment because rushing water washes away sediment and debris. Areas with slower than expected water flow allow sediment to build up inside the pipe and create clogs.

**Drainage System Interaction with Tides**

Mr. Connor noted that the drainage system would work better without tides because water would flow out more easily. If the system were free from rising tide waters, more pipes would be open more frequently to outflows. Currently, some pipes are partially underwater during the high tide cycle. The high tide slows outflow, and even causes water to flow inland. Currently, tail end pipes, especially those in tidal inlet areas, can fill with sediment or be surrounded by sediment drifts each of which slow outflows. An example of this problem is the drainage at Trumpet Creeper near 1 Governor’s. In that area, tidal inlet mud covers the drainage pipe. This mud barge slows outflow. Mr. Connor noted that KICA has allotted $500,000 to spend on clearing the Trumpet Creeper pond drainage area.

**Improving Drainage**

Mr. Connor noted more outfalls would improve drainage. In the eastern drainage basin, water falling at the V-gate travels three miles before it leaves the drainage system. If the water did not travel so far to reach an outfall, there might be less flooding and any flooding would subside faster.

Mr. Connor said if pipes were raised, there would be less tidal head pressure, water would flow outward faster, and less silt would be deposited in pipes. Raising pipes is complicated; drainage easements contain utility, cable, fiber, water and sewer lines as well as trees. Visible pipes might also be a problem for the ARB.

Mr. Chitwood suggested regular maintenance cleaning. Mr. Connor concurred that cleaning pipes every 4-5 years would improve drainage flows however, tidal inlets, like the one at Trumpet Creeper, are an exception because tides wash sediment into the low lying pipes on a daily basis.

Mr. Chitwood suggested we keep outfall gates closed at high tides for ½ day which would restrict inflow. Mr. Connor notes that that might work for some outfalls (smaller ones). He also noted the gates open and close manually and this is a time consuming process. Finally, at many points, the pipes cross the road and you must have something on which you can mount a gate.

Mr. Chitwood proposed a 30-50 year redesign which would involve adding gates to stop tidal inflow, increase the capacity of outfalls which might require bigger junction boxes and more hydraulics, and switching from boxes to circle drains. Boxes have so much activity the grout flushes away.

**Draining Ponds to Flush ponds and Pipes**

Mr. Cheney asked if draining ponds would flush the ponds and keep the pipes cleaner. Mr. Connor responded that they have not flushed the ponds. He noted that with automated gates we could drain and flush ponds.

Mr. Hill noted major preparatory drainage of ponds led to pipes collapsing during Irma, and it created several sinkholes. Hydraulic pressure pushes pipes out, effectively holding weak pipe walls in place and preventing collapse. When the system is drained, the supportive hydraulic pressure declines and weak pipes collapse.

**Pipeline Repair Timeline**

Mr. Chitwood and Ms. Mezzanotte inquired about KICA’s timeline and pipe and drainage management plans. Mr. Connor noted that there is no timeline for repairs. KICA has a set amount of money for pipe repair, and currently focuses on fixing broken pipes rather than cleaning pipes or getting ahead of emergency preparations.

Mr. Connor noted that drainage pipelines at most major road crossings are fixed, but pipelines extending into neighborhoods are still a problem.

Mr. Leffler noted that assuming a SLR of 2+ feet, cleaner pipes, round vs. square boxes and even raised pipes might not be sufficient to combat the rising sea. He suggested the committee considering what might happen if storms like October, 2015 occurred more than once every 100-1,000 years. Mr. Chitwood concurred urging the group to think about what we can best do *now,* and then establish a practice of regular review so that we learn about new solutions that may develop in the future.

Mr. Connor noted a 3-4 foot SLR is like a small storm surge and the drainage system cannot manage such water flow.

Mr. Connor noted that KICA carefully considers various scenarios and how they prioritize projects. He noted they meet with consultants and consider potential solutions like earthen dikes, flood gates, pumping stations, and more. Mr. Connor noted he is meeting an SLR assessment firm and will learn about types of solutions, cost, and duration of any proposals.

**Storm Surges and Island Drainage**

Mr. Hill and Mr. Connor noted that storm surges, especially those at high tide, are so large and fast moving that pond capacity is likely insufficient and the drainage system will have trouble managing them. Mr. Connor noted that small surges, in the order of 1-2 feet, might be small enough for the system to handle.

The speed of the storm surge moving into the ponds, especially if pond levels are low, creates washouts at roads, weirs and gates. It can also cause disintegrated pipes to collapse. Mr. Jordan noted that if the ponds fill in slowly they can better manage flooding. Furthermore, if water moves slowly into the drainage system it does less damage.

**Keeping Sea Water out of the Drainage System**

Mr. Chitwood wondered if we can preclude sea water from the entering the ponds and if pumping systems could remove tide waters. Mr. Connor noted the storm water pumping stations are expensive and unsightly.

Mr. Hill noted that the October, 2015 rain produced substantial local rain fall, and a great volume of water flowing down from upstate. All this water was coupled with a particularly high tide of 9.7 ft above MLLW which breached roads. Standard King Tides won’t breach the roads, but a high tide coupled with a storm surge could be large enough to breach the roads. The roadways are at either 6 or 6.5 ft elevation above MSL. King tides are normally 7.5 to 8 ft. above MLLW.

Mr. Chitwood wondered if we can elevate the low side of the island so that it could manage tidal events. We should also implement a trigger point system that would cause us to reassess the situation looking for new ways to manage the waters.

**Outside Funding Sources**

Ms. Mezzanotte noted many consulting firms work with government money and wondered if we might apply for grants to identify and implement SLR problems and solutions. Mr. Kotz wondered if money would go to KICA or TOKI. Ms. Mezzanotte pointed out that TOKI has responsibility for infrastructure before the gate; KICA is everything behind the gate. TOKI controls zoning, and may be able to work with the ARB and KICA.

Mr. Elliott noted that accepting state or federal funds always come with loss of security and privacy for the island. He also noted that TOKI may be able to sell bonds.

Mr. Connor notes mortgages are 30 years, and that solutions are likely to be considered on a site by site basis.

**Flooding and Island Access**

Mr. Chitwood addressed the nuisance flooding on Kiawah Island Parkway and Governor’s Drive. Both major island thoroughfares become impassable at times due to flooding caused by storms. He suggested we set priorities for emergency transport on these roads, and consider raising the roads or buying a high profile vehicle.

Mr. Elliott expressed concern that the fire department trucks may have difficulty reaching a house when the streets are flooded. Mr. Connor noted that unoccupied houses tend to burn for quite some time until a neighbor or passerby notices the fire and alerts the fire department. The fire is usually well advanced by the time the fire department arrives not due to road problems, but rather, due to how long it takes for someone to notice and report the fire.

**Development and Drainage**

Mr. Kotz suggested we explore education about low impact developments which could be voluntary or incorporated into Town ordinances.

Mr. Chitwood suggested KIGR consider building porous structures and parking lots, especially as they are undertaking a large group of construction projects that will feature many new or redeveloped parking lots.

Ms. Mezzanotte noted the ARB could recommend green roofs or other green ideas. She has not seen anything about porous parking lots.

Mr. Elliott noted The Timbers-Kiawah plans to build a pool in the dune field at the ocean side of their property. He continued, noting that putting pools in the dune field is not a great idea, since it reduces the dunes ability to protect the island in storm surges.  And they result in significant expense.

Mr. Connors noted that the Kiawah Partners position as master builder allows them to build and use existing drainage according to KP’s engineer’s advice and without input from KICA. DHEC permits are required for storm water management. Mr. Hill noted the Ocean Park ponds drain into Willett Pond. Mr. Connor noted that as of 1/1/17 KICA may decline any infrastructure KP might want to deed to KICA.

Mr. Chitwood said KIGR, KP and KICA must be included in the planning. For example, the ARB has landscaping requirements, and certainly KP is interested in what the islands look and feel like.

**Berms and Drains**

Ms. Mezanotte wondered if sections of the island could be protected from flood water by surrounding them with berms. Mr. Ellott concurred noting it may be appropriate for specific groups of houses, or individual homes to build berms. Mr. Connor noted that berms must be built in a 4:1 ratio, thus a 4 foot tall berm must be 20 feet wide. In some cases, houses are so close to the marsh that a properly constructed berm would end up filling in marshland. Mr. Jordan noted that current laws prevent building in or filling salt water marshes.

Mr. Chitwood suggested we be selective about adding berms, and that we consider raising certain areas of a road. Subcommittee members discussed using assessments, perhaps $200, or providing property tax relief to help pay for the process.

Ms. Mezzanotte suggested we consider implementing rules about impeding water flow with consequences for those who create problems and financial subsidies for those who solve them.

Discussion about purchasing property in order to build a wall or a berm, using plants to manage flooding and building concrete walls ensued.

**November Meeting**

Mr. Leffler set the agenda for the next meeting; the subcommittee will address road, water, sewer, telecom, electric infrastructure. He expects to have a speaker from the water company.