**TESTIMONY OF STEPHEN HARPER, INTEL CORPORATION**
**BEFORE THE WATER AND POWER SUBCOMMITTEE,**
**SENATE ENERGY AND NATURAL RESOURCES COMMITTEE**
**October 30, 2019**

Thank you, Chairwoman McSally and the subcommittee, for the opportunity to testify before you on the important topic of water security and economic development. My name is Stephen Harper and I serve as Global Director of Environment, Energy and Sustainability Policy for the Intel Corporation. Manufacturing semiconductors is a water-intensive business and thus Intel places great emphasis on the security of our water supplies everywhere we operate. Intel operates in many locations globally, but of particular interest to the members of this subcommittee, we have major US manufacturing operations in Arizona, Oregon and New Mexico, as well as a facility in Colorado.

Intel is a well-known brand and company, of course, but there are key aspects of our identity that are not widely appreciated. In contrast to many other high-tech companies, which design and market their products but outsource and off-shore their manufacturing, Intel makes its own products. A majority of Intel's manufacturing and research & development occurs in the US, supporting a total of over 50,000 well-paid workers. Counting our own employees and our supplier and partner network, Intel supports over 500,000 jobs throughout the US. One consequence of this large manufacturing footprint is that, for Intel, the security of our water supplies is a direct operational priority, not just a supply chain challenge.

Some of the water used in semiconductor manufacturing is devoted to the same operations, mainly cooling, that typify many industrial operations. More uniquely, semiconductor fabs use large quantities of ultra-pure water (UPW) in various cleaning and rinsing steps as a silicon wafer goes through the many steps it takes to etch the multi-layered circuits that create and connect a chip's transistors. UPW is free of organic and inorganic contaminants and can be used to rinse wafers to remove the residue created by chemical-mechanical polishing processes.

Semiconductor manufacturing is perhaps the world's most technically complex industrial process. While each distinct Intel product has its own features, the i9 CPU chip can contain over 7 billion transistors. The manufacturing process that produces that level of compaction and complexity involves using significant quantities of both water and UPW. And recent advances have involved adding multiple layers of circuitry to our chips, increasing our water usage as each layer requires applying more water in an iterative process.

Intel's operations in Chandler, Arizona are a key part of our global presence. Employing 10,400 workers across two campuses, Intel's Arizona operations manufacture the microprocessors that power data centers, PCs and hundreds of millions of smart and connected devices worldwide. We are in the process of investing more than $7 billion

to complete our latest Fab 42, which is expected to be one of the most advanced semiconductor factories in the world.

Water is an important ingredient not just in Intel's manufacturing process, it also plays a large part in our relationship with local communities. As a company, we've been investing in water conservation projects and setting ambitious water conservation goals for close to two decades, saving close to 64 billion gallons of water since we started tracking our progress in 1998. Last year, we conserved close to one billion gallons of water in Arizona – and we've returned more than 5 billion gallons of water from our manufacturing operations to replenish Arizona's water supply since the mid-1990s.

Although we continue to invest millions of dollars each year to conserve water and increase our water use efficiency – including in Arizona – our water needs are growing along with company growth and manufacturing complexity. This led us to ask – what else should we be doing? The answer was to look at the bigger picture – beyond our own operations – and examine Intel's role in the watersheds where we operate.

Our onsite water management practices allow us to return approximately 80% of the water we use back to our communities – to be reused or to recharge groundwater supplies. In Arizona, a big component of our effort to reclaim and recharge water to the local aquifer is the Ocotillo Brine Reduction Facility (OBRF). The OBRF is a reverse-osmosis (RO) treat operation that processes 1.5 million gallons daily of water that can be used to recharge the aquifer or for reuse elsewhere in the community. Built by Intel, the OBRF is owned and operated by the City of Chandler, with O&M funding coming from Intel. Since its inception, more than 5.1 billion gallons have been recharged into the local aquifer, enough to support 35,000 households for a year. We are also building a facility at our newest Arizona factory that, once operational, will be able to process and treat approximately millions of gallons of wastewater each day for additional reuse on site.

These on-site actions leave us with a 20% gap in our water balance – water that is consumed within our operations, primarily through evaporation in our cooling towers or taken up by plants in landscaping. To address this gap, in 2017 we announced a new global commitment to restore 100% of the water we use by 2025. This means that for every gallon of freshwater we use, we will restore a gallon to our watersheds or communities, through existing water management practices and water conservation investments in our operations as well as supporting local water restoration projects.

To achieve this ambitious goal, we are engaging local community, nonprofit and conservation organizations to identify and fund projects that aim to address local water issues and support the well-being of communities and the environment. To date, Intel has funded seven projects in collaboration with nonprofits to support Arizona watersheds. Once completed, these projects will restore close to half a billion gallons of

water to the environment each year, for around 10 years or more. Our project partners vary by site, but include The Nature Conservancy, National Forest Foundation, Trout Unlimited, and the Arizona Land and Water Trust.

The restoration benefit of each project is quantified by a third party, LimnoTech, and is detailed each year in an annual report published to our www.intel.com/water webpage. To guide us through this process, we relied on support from the Bonneville Environmental Foundation. Their engagement and guidance have been instrumental in our success.

By partnering with these organizations, we hope to support the environment, wildlife, and people who rely on this critical natural resource. We are the first technology company to commit to a goal and initiative of this scale, and we are proud of our long-standing commitment to the environment. While we will remain focused on managing our water use efficiently, we know that broadening our focus beyond our own operations will help us have a greater sustainable impact on the environment. Our hope is that others in the technology industry – or any industry – will join us on this journey. We believe that we all have a responsibility to address the global water challenges that confront us.

Getting back to the subject of this hearing…water security and economic development, water availability is important at our other facilities as well, including in Oregon, even though the Portland metro area tends to be as wet as Phoenix is arid. Intel employs approximately 20,000 in Oregon and we have invested over $40 billion in our operations there over the last 44 years. Following our example in Arizona, we have announced a goal to restore 100% of our global water use by 2025 through internal actions and collaborative community-based projects. Within our own operations we are building a water recycling facility at our Ronler Acres campus to support our manufacturing operations.

Finally, I would like to move beyond how we manage our own operations to ensure security of supply and how we collaborate with our communities and local conservation groups. I would like to close by pivoting to a focus on how our technology, and information technology (IT) generally, can be employed to advance water security and economic development. In a coincidence of timing, that topic was the focus of a workshop co-convened by the Environmental Law Institute (ELI) and Water Foundry last week in Denver. Titled “Digital Technology Opportunities for the Colorado River Basin,” this workshop and a preliminary discussion paper were funded by Intel, Microsoft and Blue AB.

The report and workshop identified specific examples of how Artificial Intelligence (AI), Blockchain, sensor networks, and other applications of IT can significantly improve water management, security and resiliency in the increasingly water-stressed Colorado River Basin (CRB). AI systems can be used to improve water basin modeling and forecasting, for example. Blockchain could be used to enable peer-to-peer water

trading, which could materially improve the efficiency of water management in large basins. The availability of more accurate and cheaper sensors could enable dramatic improvements in the real-time monitoring and management of hydrologic systems like the Colorado River Basin. Employed at the tap, sensors could improve the tracking and metering of water use by customers and eventually real-time water quality monitoring. Beyond simply pointing out the potential of these technologies, the report cites current examples or use cases. Employed in various combinations, these technologies begin to comprise what experts are calling the Internet of Water and can help us maintain economic development, business growth and ecosystem health. The deployment of digital water technologies will benefit the state economies of the Colorado River Basin.

IT can also be brought to improve water quality as well as quantity. Exemplary work is being done in that realm by organizations applying remote sensing to analyzing the impact of land uses upon water quality. In the Chesapeake Bay, for example, the Chesapeake Conservancy is combining high-resolution satellite imagery, sophisticated geographic information systems (GIS), and cloud computing to precisely map where water flows off land parcels into the Bay. This enables them to partner with landowners to precisely locate where buffers and other water quality best practices should be located to have maximum impact at minimum cost. Such "precision conservation" technology combined with increasingly available low-cost water sensors hold the promise of making it possible to design point/non-point water quality effluent trading programs, greatly reducing the cost of cleaning up estuaries and other extensive water resources. In another innovative application of IT, the Freshwater Trust in Oregon uses sophisticated stream temperature sensors to enable development of so-called "temperature trading." Such programs employ verified stream temperature reductions created by stream-side tree planting to render unnecessary much more expensive installment of water effluent cooling infrastructure at upstream industrial plants.

Finally, in an application that serves the objectives of both water quality improvement and water quantity conservation, there is burgeoning realm of "precision agriculture." Remote sensing (from satellites, planes and drones) combined with in-field sensors can, for example, help farmers more accurately monitor soil moisture conditions and crop health, enabling the application of the minimum amount of irrigation needed at just the right time to promote maximum crop yields. Similar approaches can be applied to fertilizer and pesticide management. Reduced irrigation carrying reduced amounts of fertilizer and pesticide translate directly into improved conditions in receiving water bodies.

In closing, Intel applauds the Subcommittee for examining the importance of water security to companies like Intel as well as the link of water security to economic development. We urge the Subcommittee to further examine the role of IT applications in the service of improving both the security and quality of water supply, especially in arid regions like the Colorado River Basin. Through funding basic research, procurement and other means, the Federal government can help advance the pace of progress in this field.