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May 2, 2015

Ms. Kristen Lambert, President  
Friends of the Oswegatchie Hills Nature Preserve  
P.O. Box 163  
Niantic, Connecticut 06357

Mr. Fred Grimsey, President  
Save the River-Save the Hills  
P.O. Box 505  
Waterford, Connecticut 06385

Re: Riverview Heights  
Calkins Road  
East Lyme, Connecticut

Dear Ms. Lambert and Mr. Grimsey,

At the request of The Friends of the Oswegatchie Hills Nature Preserve and the Save the River-Save the Hills, I have reviewed the preliminary site plans prepared by Hesketh & Associates, Inc. for the Riverview Heights affordable housing proposal. I have also reviewed the summary portion of the preliminary pollution prevention & Stormwater Management Plan prepared by Hesketh & Associates, Inc. with both having a February 4, 2015 date.

Summary Description of Stormwater Management plan by Hesketh & Associates, Inc.:

1. The applicant is proposing to address only the Water Quality Volume and Groundwater Recharge Volume as found in the CT DEP 2004 Storm Water Quality Manual, but not the Channel Protection Flow or Peak Rate Attenuation standards.
2. The applicant's justification for not meeting the Channel Protection Flow standard is that the discharges are not directed to a stream or other waterbody.
3. The applicant justifies that providing peak rate attenuation of post-development is not necessary as the site area is less than 5% of the contributing watershed to the Niantic River at this point.
4. The applicant further claims that runoff being directed to the west and east will be less than pre-development conditions both in regard to volume and peak rate as it will be directed into underground drywells.

5. The stormwater management proposal consists of four Water Quality Basins according to the applicant.
6. There are three discharge pipes for the stormwater management system along the boulevard style access road into the site that are not directed to any stormwater treatment system.
7. The discharge pipes from all four basins outlets and the road drainage all are directed onto upland areas outside the defined 100 foot upland review area of the East Lyme Inland Wetland Regulations.

The focus of this initial review is to determine if the proposed water quality basins will cause an adverse physical or chemical impact to the down gradient wetlands and/or watercourses. The proposed development plan will create approximately 36 acres of directly connected impervious areas consisting of roof tops, driveways and parking lots that will convey storm water by structural conveyance systems (catch basins and pipe) to the water quality basins as proposed.

**Based upon the above information, the design proposed by the applicant will cause adverse physical and chemical impacts to the down gradient wetlands and watercourses on this site.** Detailed explanations are provided below:

1. According to the plans, the proposed water quality basins will receive runoff from all storm events. Some of these storm events will be more significant than the water quality storm event of one inch of rain in 24 hours, which is used in the applicant's calculations. As the Channel Protection Flow and Peak Rate Attenuation are not being provided, there will be increased volumes and rates of runoff directed to all of the proposed discharge points, which will only intensify the impacts presented below:
2. Water Quality Basin #1:
  - a. This basin is located to the east of the proposed development at the southern end of the project. The outlet pipe from the basin is located just outside the 100 foot upland review area on a moderate to steep slope. The discharge is not directed into an existing stabilized location.
  - b. The discharge of concentrated flow onto this slope for a length of 100 feet or more will cause a channel to be eroded in the upland area as the natural slope does not currently experience concentrated runoff. The concentrated flow discharged here will result in eroded material being conveyed and discharged into the down gradient wetlands. A small riprap pad or plunge pool will only initially slow the velocity of the discharge and the continuous discharge of runoff from all sizes of rainfall events will re-concentrate as it runs down and erodes existing soils.
  - c. Additionally, there is no assessment of the anticipated pollutant loads that will be directed from the proposed development area nor any assessment that the proposed basins will adequately reduce the pollutant loads for the following pollutants:
    - i. Total Suspended Sediments
    - ii. Total Phosphorous

- iii. Total Nitrogen
- iv. Petroleum Hydrocarbons
- v. Metals

3. Water Quality Basin #2:
  - a. This basin is located to the east of the proposed development area. The outlet pipe from the basin is located just outside the 100 foot upland review area on a moderate to steep slope. The discharge is not directed into an existing stabilized location.
  - b. The discharge of flow onto this slope for a length of 100feet or more will cause a channel to be eroded in the upland area as the natural slope does not currently experience concentrated runoff. The same issue described for Basin #1 above will also occur here.
  - c. As noted for Basin #1, there is no evaluation of the pollutant loads and the effectiveness of the Basin #2 to reduce the loads that will result in a discharge of pollutants to the wetlands.
  
4. Water Quality Basin #3:
  - a. This basin is located to the east of the proposed development area at the intersection of the access driveway. The outlet pipe from the basin is located on a moderate to steep slope. The discharge is not directed into an existing stabilized location.
  - b. The discharge of flow onto this slope for a length in excess of 300feet or more will cause a channel to be eroded in the upland area as the natural slope does not currently experience concentrated runoff. The same issue described for Basin #1 above will also occur here.
  - c. As noted for Basin #1, there is no evaluation of the pollutant loads and the effectiveness of the Basin #3 to reduce the loads that will result in a discharge of pollutants to the wetlands.
  
5. Water Quality Basin #4:
  - a. This basin is located to the east of the proposed development area at the intersection of the access driveway. The outlet pipe from the basin is located on a moderate to steep slope. The discharge is not directed into an existing stabilized location.
  - b. The discharge of flow onto this slope for a length in excess of 200feet or more will cause a channel to be eroded in the upland area as the natural slope does not currently experience concentrated runoff. The same issue described for Basin #1 will also occur here.
  - c. As noted for Basin #1, there is no evaluation of the pollutant loads and the effectiveness of the Basin #4 to reduce the loads that will result in a discharge of pollutants to the wetlands.
  
6. Three drainage discharges along the proposed access driveway:

- a. The three discharges from the access driveway will convey runoff from the proposed impervious area discharge directly onto upland soils and not into an existing stabilized location.
- b. The discharge of flow onto this slope for a length in excess of 300 will cause a channel to be eroded in the upland area as the natural slope does not currently experience concentrated runoff. The concentrated flow being discharged here will result in eroded sediments then being conveyed and potentially discharged into the Niantic River as no wetland areas are located down gradient of this point. A small riprap pad or plunge pool will only initially slow the velocity of the discharge and the continuous discharge of runoff will concentrate and cause the erosion.
- c. There is no water quality treatment proposed for these three discharge points, so pollutants found in the non-point source will be discharged directly into the Niantic River.

The following are additional items of concern that will also exacerbate the adverse impacts to wetlands and watercourses on this site as noted above:

1. The proposed site plan also shows that the existing ridge line will essentially be flattened with cuts ranging from a few feet to in excess of 20 feet. In addition, there are several areas where fills over 10 feet in depth will be required for the project. Earthwork of this magnitude poses a significant risk of sediment discharges during the construction period that can easily overwhelm perimeter erosion controls and reach down-gradient wetland areas.
2. According to the NRCS websoil survey, the majority of the soils in the area of the proposed development consist of Charlton and Hollis, both of which are shallow to bedrock, yet the applicant's stormwater report states that infiltration drywells will be used for roof runoff. Water simply does not infiltrate into bedrock and by placing drywells into the bedrock, this component of the stormwater management system will fail resulting in the discharge of pollutants into the environment.
3. The stormwater report also states that the proposed water quality basins are located in "moderate to moderately rapid permeability soils with a deep groundwater table that will drain any surface water in the basin to below the bottom of the basin between storm events." Based upon the soil types discussed in #2 above, bedrock will likely be encountered well before the design depths are achieved, thus the statement that infiltration will occur in the four water quality basins is not valid. If infiltration does not occur, the Groundwater Recharge Volume requirement will not be met. Additionally, there will be increased runoff volumes directed toward the downgradient wetland areas. A review of the preliminary plans shows that the bottoms of the proposed water quality basins will be located at significant depth below the existing grade. The following is the average depth of cut from existing grade to the bottom of each basin.
  - a. Bottom of Basin #1 is 20 feet below existing grade.
  - b. Bottom of Basin #2 is 13 feet below existing grade.
  - c. Bottom of Basin #3 is 9 feet below existing grade.
  - d. Bottom of Basin #4 is 6' below existing grade.

4. Due to the directly connected impervious area, this site will generate substantial pollutant loads during every rainfall event. The source of pollutants generally consist of the following:
  - a. Sand and salt used in the winter maintenance operations on the driveways, parking areas and sidewalks. The applicant states in the submitted stormwater report that calcium chloride will be used instead of sodium chloride, and implies that calcium chloride is better than sodium chloride. This is not the case, the chloride component of a salt is the pollutant of concern in the environment as it stays in solution for a long time.
  - b. Nutrients (phosphorous and nitrogen) from the fertilization of grass and landscaped areas as well as atmospheric deposition as discussed below.
  - c. Metals from brake pads of vehicles which will utilize the site, including cars, and trucks.
  - d. Hydrocarbons from oil drips and inadvertent gasoline spills on to impervious areas.
5. An often overlooked source of non-point source pollutant is atmospheric deposition. Research reported by North Carolina State University has shown that up to 91% of nitrate loads and 38% of the total nitrogen load found in runoff was the result of atmospheric deposition directly on impervious surfaces. Further studies from Charlotte, NC have found that between 10-13% of phosphorous and total suspended solids along with 30-50% of copper and lead and 70-90% of nitrogen in runoff was the result of atmospheric deposition. Nitrogen is an important concern in a tidal estuary such as the Niantic River as it can adversely affect submerged aquatic grasses, such as eelgrass, and plants found in tidal marsh areas.

Please contact my office if you have any questions concerning this information.  
A copy of my current CV is appended to this letter.

Respectfully Submitted,  
Trinkaus Engineering, LLC



Steve Trinkaus, PE, CPESC, CPSWQ

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**Qualifications** B.S. / Forest Management/1980  
University of New Hampshire

**Licenses/Certifications** Licensed Professional Engineer-CT Connecticut (1988)  
Certified Professional in Erosion and Sediment Control (2005)  
Certified Professional in Storm Water Quality (2005)

**Professional Societies** American Society of Civil Engineers  
National Society of Professional Engineers  
Connecticut Society of Professional Engineers  
Soil and Water Conservation Society of America  
International Erosion Control Association  
American Society of Agricultural and Biological Engineers

### **International Experience**

#### **South Korea – April 2015, October 2014, April 2014, October 2013 and June 2013**

- Steve was an invited presenter at the World Water Forum by Dr. Hyunsuk Shin of Pusan National University. He presented case studies of GI/LID applications in the United States.
- Steve was invited by Dr. Yong Deok Cho of Kwater to participate in the Water Business Forum at the World Water Forum. Steve presented an overview of his business and expertise in Low Impact Development.
- Steve was invited by Dr. Hong-Ro Lee of Kunsan National University and made a presentation entitled “Understanding Low Impact Development in the Urban-Rural Interface” for the **Ariul Brainstorming Working Group** on April 16, 2015 in Gunsan, South Korea. He also toured portions of the proposed land reclamation area to assess how Low Impact Development strategies could be incorporated to address water quality issues from the proposed agricultural, residential, commercial and industrial land uses for this area.
- Steve was a Contributing Author as well as an Advisory Reviewer for a report prepared by Land & Housing Institute (LHI) entitled “Pyeongtaek Godeok New City Low Impact Development techniques (LID), A study on the introduction of measures (I) “ dated: January 2015. This report by LHI also cited the Town of Tolland LID Design Manual as a foreign LID Manual to be used as a reference document.
- Steve was an invited presenter at the International Water Forum 2014 held in conjunction with the Nakong River International Water Week in Gyeongju, South Korea sponsored

by DaeGyeong Water Foundation & the International Hydrologic Environmental Society. His presentation focused on urban stormwater and the benefits of LID in these areas.

- Steve was an invited presenter at the IWA Water Reuse & Energy Conference 2014 held in Daegu, South Korea. His presentation was on the regulatory barriers to implementation of LID and how to overcome these barriers. He also participated in a panel discussion with other presenters.
- He also made a presentation at The 1<sup>st</sup> GI & LID Technical Education Workshop held at Pusan National University on October 22<sup>nd</sup> on an overview of LID and the application of LID concepts. He was invited by Dr. Kyung Hak Hyun of Land & Housing Institute (LHI) to make two presentations of LID case studies at Sangyung University and at a seminar hosted at LHI along with Kwater.
- Steve met with Jong-Pyo Park, Director and Kyoung-Do Lee, CEO of HECOREA, a water resource consulting firm to discuss LID in dense urban areas. Steve signed a MOU with HECOREA to provide consulting services on LID monitoring approaches and maintenance protocols for the Go-Deok International Planning District near Pyeongtaek, South Korea.
- Steve was invited by Dr. Kyung Hak Hyun of Land & Housing Institute to present at the 2<sup>nd</sup> Low Impact Development Forum in Daejeon, South Korea on October 31, 2013. He also inspected the site of Asan-tangjeong which is an expansion of residential housing for the city of Asan. This expansion will incorporate LID stormwater strategies.
- Steve was invited to make a presentation of the implementation of LID on commercial sites by Dr. Reeho Kim of the Korea Institute of Construction Technology in Seoul.
- Steve met with Dr. Sangjin Lee of Korean Water and Dr. Woo Young Heo, CEO of LID Solution Co, Ltd to review the initial concept plans for the Eco-Delta City project. Eco-Delta City is a new city located near the Gimhae International Airport of 13 square kilometers and will incorporate LID concepts throughout the new city.
- Steve signed a MOU with Dr. Shin of Pusan National University to provide consulting services for the Smart GI/LID Research Facility at Pusan National University. Steve was asked by Dr. Shin to review the design plans for the GI/LID research facility to be constructed at Pusan National University with a focus on the exterior LID research facilities. He provided a written comprehensive review for consideration by PNU.
- Steve was invited by Dr. Hyunsuk Shin of Pusan National University in South Korea to present a workshop on Low Impact Development on June 24, 2013. The presentation was made to research professors, graduate engineering students and practicing engineers at K-water headquarters in Daejeon, South Korea. He also met with representatives of other agencies tasked with the development of a new city, called Eco-Delta City which will implement LID practices from the ground up and comprises approximately 3,500 acres.

### **Guangzhou, China – December 2012**

- Steve was an invited attendee at the 15<sup>th</sup> Annual Guangzhou Convention of Chinese Scholars in Science and Technology in Guangzhou, China on December 17 – 21, 2012 to present a project narrative on how Low Impact Development and sustainable development can be applied to address water quality issues in urban and rural areas of China to implement sustainability concepts and conservation of resources. He attended with Dr. Jim Su, PE of Golder Associates of Mt. Laurel, New Jersey. While at the

convention he met with representatives from Sichuan University, Chang'an University, Guangdong University of Technology, Shenzhen University and the South China Institute of Environmental Sciences, MEP to discuss LID being incorporated into their engineering programs.

- Steve also met Dr. Hongbin Cheng of New China Times Technology which is located in Stellenbosch, South Africa. Steve has signed a three year partnership agreement with New China Times Technology to introduce LID concepts to the west cape area of South Africa.

### **Taiwan – December 2011**

- Steve was invited by Hung Kwai Chen, Director of the Water Resources Planning Institute, Water Resource Agency, Ministry of Economic Affairs of Taiwan and Dr. Yong Lai of the US Bureau of Reclamation to present a 12-hour presentation on Low Impact Development on December 8<sup>th</sup> and 9<sup>th</sup>, 2011 in Taichung, Taiwan. The presentation focused on applying LID strategies in both urban and rural environments to address runoff volumes and water quality issues.
- Steve is an invited consultant to a project team headed up by Xiaoyan Zhou, PhD of the Institute for Taiwan Water Environment Research (TIWE) along with The National Taiwan Ocean University, Hohai Engineering Professor Liao Chaoxuan, Ting Engineering Consultants Co., Ltd and University of Colorado professor Guo Chunyuan to develop a LID demonstration project in New Taipei City along with LID policy strategies to further the use of LID in New Taipei City, Taiwan.

### **Future Presentations and Workshops**

- Steve has been invited by Professor Nian She of Shenzhen University to make a presentation entitled “Using LID to Attenuate Large Rainfall Events and Reduce Flood Potential” at the **2015 First Sino US Sponge City LID Technology Practice Conference** ( [http://www.c-water.com.cn/2015lid/en/index\\_e.html](http://www.c-water.com.cn/2015lid/en/index_e.html) ) to be held on May 4-5, 2015 in Zhenjiang, China organized by Zhenjiang Water Supply and Drainage Management Office.
- Steve has been invited by the Lake George Waterkeeper to make a presentation entitled “Applying LID Concepts in the Real World” at the 5<sup>th</sup> Annual Low Impact Development Conference being held in Lake George, NY on May 7, 2015. ( <http://fundforlakegeorge.org/2015LID> )
- Steve will be making a presentation entitled “Designing Low Impact Development treatment systems for **Urban & Agricultural Environments**” at the **Annual US-Korea Conference on Science, Technology, and Entrepreneurship** being held in Atlanta, Georgia on July 29 to August 1, 2015. ( <http://www.ukc.ksea.org/UKC2015/> )
- Steve will be making a presentation entitled “Solving Construction Stormwater Problems in the Field” at **WEFTEC 2015** ( <http://www.weftec.org> ) in Chicago, IL at the end of September 2015.

### **Low Impact Development**

- Review of existing municipal land use regulations to identify barriers to the implementation of Low Impact Development

- Preparation of regulatory language changes to facilitate the adoption of Low Impact Development
- Preparation of design manuals for the implementation of Low Impact Development strategies and processes with an approach that simplifies the design process
- Application of environmental site design strategies to focus development concepts on land most suitable for development while enhancing the protection of environmentally sensitive areas
- Design of Low Impact Development treatment systems, such as Bioretention areas, wet/dry swales, vegetated level spreaders, vegetated filter strips, subsurface gravel wetlands, constructed wetlands and/or pond systems, infiltration basins & trenches
- Hydrologic analyses of current and post-development conditions to assess impacts of proposed development on storm water flows
- Design of storm water control systems including detention and water quality basins and appropriate planting plans
- Perform hydrologic modeling of stormwater management systems to demonstrate compliance with regulatory benchmarks
- Prepare Pollutant loadings analyses to evaluate the effectiveness of stormwater treatment designs in reducing pollutant loads

### **Wastewater Management:**

- Soil testing to determine suitability of land to support on-site sewage disposal systems for residential and commercial projects and assistance with identifying optimal location for both small and large scale system
- Perform necessary calculations to model and design large scale subsurface sewage disposal systems under CT DEEP criteria and State Department of Public Health
- Design of on-site sewage disposal systems in accordance with state and local health codes
- Perform construction oversight of both small and large scale subsurface sewage disposal systems and provide certifications of compliance

### **Site Engineering:**

- Development feasibility studies
- Layout concepts to maximize development, while preserving environmentally sensitive areas
- Design of horizontal and vertical road geometry
- Preparation of grading, drainage and erosion and sedimentation control plans
- Use AutoCAD Land Development, Civil3D, HydroCAD and Pondpack software packages

- Layout and design of sanitary sewers
- Bid estimates
- Construction oversight
- Third party technical reviews
- Expert testimony

### **Professional Committees**

- Chairman and primary author of EWRI/ASCE LID Model Ordinance Task Committee (goal is to create a National LID Guidance document to further the adoption of LID)
- Chairman of EWRI/ASCE LID Task Committee on Filter Strips and Bioswales (goal is to review & evaluate literature and design specifications for filter strips and Bioswales and create uniform design standards for different geographical regions)
- Member of EWRI/ASCE LID National Guidelines Task Committee
- Connecticut Representative to the Board of Directors of the Northeast Chapter of the International Erosion Control Association

### **Published Articles**

- **“Research team leads LID deployment in South Korea”** – Volume 2/Issue 1, Spring 2014 – Worldwater Stormwater Management by the Water Environmental Federation.
- **“Low Impact Development, Sustainable Stormwater Management”** – English article converted to Chinese and published in the Chinese Edition of Global Water Magazine, July 2013.
- **“A Case Study: Southbury Medical Facility and Low Impact Development”** - January/February 2014 issue of Land and Water.
- **“A True Pioneer of Low Impact Development – Member Spotlight”** – January/February 2014 Issue of Erosion Control – Official Journal of the International Erosion Control Association.
- **“Low Impact Development: Changing the Paradigm”** published in the March 2012 edition of PE, The Magazine for Professional Engineers by the National Society of Professional Engineers. Article was also republished in the Spring 2012 addition of EWRI Currents (with permission of NSPE).
- **“Stormwater Retrofit of Existing Detention Basins”** published in the March/April 2012 Land and Water, The Magazine of Natural Resource Management and Restoration with co-author Sean Hayden of the Northwest Conservation District.
- **“Out in the Open; Creating a Stormwater Park in the Heart of a Community”** published in the April 2013 issue of WaterWorld by Pennwell Corporation.
- **“Creating a Stormwater Park in the City Meadow of Norfolk, Connecticut”** published in the July/August 2013 edition of Land and Water

### **Volunteer Organizations**

- President (elected 11/2013) and Connecticut Representative to the Board of Directors for the Northeast Chapter of IECA, (Chairman of 2012 Annual Conference to be held in Fishkill, NY)
- Chairman, Water Pollution Control Authority for the Town of Southbury

- Alternate member of Inland Wetlands Commission Town of Southbury (served three years)
- Northwest Conservation District Board of Directors (served 18 months)

### **Software Development**

Developed a proprietary software application called **Assessment of Pollutant Loads and Evaluation of Treatment Systems (A.P.L.E.T.S.)**. This application calculates the pollutant loads for current and future land use conditions for the seven most common pollutants in non-point source runoff (TSS, TP, TN, Zn, Cu, TPH, & DIN) for a total of twenty two different types of land uses. The application then allows the evaluation of the effectiveness of thirty four Conventional and Low Impact Development treatment systems in removing these pollutants. Up to four treatment systems can be used in a row as a treatment train to achieve water quality goals.

### **Conferences Attended**

- Bioretention Summit: Ask the Researcher – Annapolis, MD by the University of Maryland (Dr. Alan Davis), North Carolina State University (Dr. Bill Hunt) and Villanova University Stormwater Partnership (Dr. Rob Traver) – (July 2010).
- Workshop at the University of New Hampshire Stormwater Center on permeable pavements. This full-day training included field visits to a variety of on-the ground porous pavement installations throughout the region. Participants learned key design principles necessary to successfully design, evaluate, specify, and install porous pavement for stormwater management. (December 2009).
- Two workshops at the University of New Hampshire Stormwater Center in Durham, NH to observe conventional and Low Impact Development storm water treatment systems in operation. The Stormwater Center is independently verifying the effectiveness of the various treatment systems to remove pollutants from runoff and reduce impacts associated with storm flows. (March 2006 and May 2007).
- 2<sup>ND</sup> National Low Impact Development Conference – North Carolina State University held in Wilmington, NC, (March 2007).
- Designing Bio/Infiltration Best Management Practices for Stormwater Quality Improvement – University of Wisconsin (Madison, WI) (November 2005).
- Stormwater Design Institute – Center for Watershed Protection (White Plains, NY), (December 2004).
- Engineering and Planning Approaches/Tools for Conservation Design – University of Wisconsin (Madison, WI) (December 2003).
- Law for Design Professionals in Connecticut – Lorman Education Services in Trumbull, CT (September 2002).
- On-site Wastewater Facility Design – University of Massachusetts in Amherst, MA (May 2002).
- The Northeast Onsite Wastewater Short Course & Equipment Exhibition – New England Interstate Water Pollution Control Commission in Newport, RI (March 2002).

- Designing On-site Wetland Treatment Systems, University of Wisconsin, (Madison, WI) (October 1999).
- Cost Effective Drainage System Design – University of Wisconsin (Atlanta, GA) (November 1997).
- Treatment Wetlands, University of Wisconsin, (Madison, WI). “Creating and Using Wetlands for Wastewater Disposal and Water Quality Improvement” (April 1996).
- Alternative On-site Wastewater Treatment Systems, New England Intrastate Pollution Control Commission’s On-Site Wastewater Task Force in Westford, MA (November 1994).
- Stormwater Quality, University of Wisconsin, (Portland, ME). “Designing Stormwater Quality Management Practices” (June 1994).

### **Invited Speaker Presentations:**

- Steve was invited by Dr. Hyunsuk Shin and made a presentation entitled “Real Adaptation and Implementation of GI and LID Technology in USA” at the **World Water Forum** (<http://eng.worldwaterforum7.org/main/>) being held in Daegu, South Korea on April 14, 2015.
- Steve prepared a presentation for a workshop to civil and environmental engineering students at **Pusan National University** ([http://www.pusan.ac.kr/uPNU\\_homepage/kr/default.asp](http://www.pusan.ac.kr/uPNU_homepage/kr/default.asp)) in Busan, South Korea on April 17, 2015 entitled “Designing LID System, What do you need to know and why”.
- Steve was invited by Dr. Hong-Ro Lee of Kunsan National University and made a presentation entitled “Understanding Low Impact Development in the Urban-Rural Interface” for the **Ariul Brainstorming Working Group** on April 16, 2015 in Gunsan, South Korea. It will focus on how Low Impact Development concepts can be applied to made land areas filled in off the west coast of South Korea to address water quality issues.
- Steve was an invited speaker at the **2014 Low Impact Development Conference** sponsored by the Lake George Waterkeeper and the The Fund for Lake George in Lake George, NY on May 1, 2014 for land use professionals and regulatory agencies. He will be presenting case studies focusing on the application of LID concepts for commercial and residential projects.
- Steve was invited by Justin Kenney, Green Infrastructure Coordinator of the Vermont Department of Environmental Conservation Watershed Management Division to present an eight hour workshop entitled “From Bioretention to Permeable Pavement: An In-depth Introduction to Low Impact Development and Green Stormwater Infrastructure” in Montpelier, Vermont on December 5, 2013. The presentation was hosted by the **Vermont Green Infrastructure Initiative** with support from the following Vermont Agencies and Divisions; **Building and General Services, Ecosystem Restoration Program and Agency of Transportation.**
- Steve was invited to attend and present on the Application of LID Concepts for the Urban Environment and LID Case Studies at the 2<sup>nd</sup> Low Impact Development, Stormwater Management Forum hosted by the **Land & Housing Institute, Korean Land & Housing Corporation** to be held in South Korea in on October 31, 2013. He also made presentations at the **Korean Institute of**

**Construction Technology and Pusan National University** on various aspects of LID during this time.

- Steve was an invited speaker at the **2013 Low Impact Development Conference** sponsored by the Lake George Waterkeeper and the The Fund for Lake George in Lake George, NY on May 2, 2013 for land use professionals and regulatory agencies. Over 80 design professionals and regulatory people were in attendance. He made a presentation entitled “Barriers to the implementation of LID”.
- Steve was an invited presenter at a closed-meeting of the **National Association of Home Builders (NAHB) and the Water Environment Federation (WEF)** on October 10, 2012 focusing on progressive stormwater management. The presentation focused on the application of LID strategies on actual development projects and discussed the hydrologic performance and cost effectiveness of LID design.
- Steve was the invited presenter for a 1-hour long webinar presented by **Stormwater Solutions and Stormwater USA** on Low Impact Development and the Basics of Bioretention held on September 18, 2012. Over 760 individuals watched the webinar.
- Steve was an invited speaker at and **EPA/WEF Stormwater Technical Meeting** on July 18, 2012 in Baltimore, MD to discuss the application of Low Impact Development strategies for actual projects with a focus on cost effectiveness when compared to conventional stormwater management as well as field performance of the LID designs. The purpose of this meeting was to assist EPA in the development of a National Stormwater Rule.
- Site Design using Low Impact Development Strategies and What are the impacts of Impervious Cover on Water Quality and Quantity were presented at a workshop entitled “Challenges and Solutions using Low Impact Development”, sponsored by the **Lake George Waterkeeper** in Lake George, NY on May 5, 2011 for land use professionals and regulatory agencies. 90 design professionals and regulators in attendance.
- Steve was an invited speaker at the **2012 Low Impact Development Seminar** sponsored by the Lake George Waterkeeper in Lake George, NY on April 25, 2012 for land use professionals and regulatory agencies. 100 design professionals and regulatory people were in attendance. He made a presentation entitled “The Hydrologic Benefits of Vegetation in Site Design”.

### **Conference Presentations:**

- Steve made three presentations entitled: “Korean GI/LID Research Facility”, Applying LID concepts to High Density Residential Developments, and Municipal LID Regulations” at the 2015 Environmental Connection IECA Annual Conference being held in Portland, Oregon on February 16 – 18, 2015. He also presented a half day workshop entitled: “Designing LID Projects”. He moderated an Expert Panel on Low Impact Development with Seth Brown, (Water Environment Federation), Bob Adair (Construction Ecoservices, Inc.) and Roger Sutherland (AMEC)
- Steve made two presentations at International Low Impact Development Conference 2015 in Houston, Texas which is sponsored by ASCE-EWRI. The presentations are entitled “Korean GI/LID Research Facility”, and “LID Demonstration Projects in Connecticut: The Good and the Bad”.
- Steve made presentations entitled “Overview of Low Impact Development” and “The Application of Low Impact Development Strategies for Land Development Projects” along with Dr. Jae Ryu of the

University of Idaho and Dr. Hyun-Suk Shin of Pusan National University at the annual meeting of the **American Water Works Association** in Tyson Corners, VA on November 6, 2014.

- Steve made two presentations entitled “Construction Site Stormwater: The Ignored Problem” and “Applying LID Concepts to High Density Residential Development” at the **2014 Annual Conference and Trade Show of the Northeast Chapter of IECA** held at Lake Morey, Vermont on November 4 – 5, 2014.
- Steve made the following presentations entitled: “A Case Study – Southbury Medical Facility and Applying LID concepts on undeveloped land and in the urban environment” at Municipal Wet Weather Stormwater Conference, hosted by the **Southeast Chapter of IECA** in Charlotte, NC on August 18<sup>th</sup> and 19<sup>th</sup>, 2014.
- Steve made the following presentations: “The Incorporation of LID on Affordable Housing Projects, A Case Study – Southbury Medical Facility and LID’ and Municipal LID Regulations” at the **16<sup>th</sup> Annual EPA Region 6 Stormwater Conference** sponsored by the South Central Chapter of IECA in Fort Worth, TX on July 27<sup>th</sup> through August 1<sup>st</sup>, 2014.
- Steve made oral presentations at the **2014 Environmental Connection** sponsored by the International Erosion Control Association in Nashville, Tennessee on February 25 – 18, 2014. The presentations were entitled “A Case Study – Southbury Medical Facility and LID”, “The Implementation of the Highland Estates Detention Basin Retrofit water quality impairment in Northfield Lake”, and “Creating Effective Municipal LID Regulations”.
- Steve co-presented an all day workshop on Low Impact Development with Jamie Houle of the University of New Hampshire Stormwater Center at the **2013 International Erosion Control Association Northeast Chapter Conference and Trade Exposition** on November 19 – 21, 2013 in Warwick, RI.
- Steve made three oral presentations at the **2013 International Low Impact Development Symposium** held at the Saint Paul RiverCentre in Saint Paul, Minnesota on August 18 – 21, 2013. The presentations were entitled “A Case Study – Southbury Medical Facility and LID”, “LID regulations in Connecticut: The Long and Tortured Road”, and “Creating a Stormwater Park in the City Meadow of Norfolk, Connecticut.”
- Steve presented two papers at the **2013 EWRI World Environmental and Water Resources Congress** held in Cincinnati, Ohio on May 19- 23, 2013. The papers are entitled: “Municipal LID Regulations - What is important to include to be successful?” and “Creating a Stormwater Park in the City Meadow of Norfolk, Connecticut”. <http://content.asce.org/conferences/ewri2013/index.html>
- Steve made a presentation at the **Soil and Water Conservation Society Winter Conference** held in Berlin, Connecticut on February 15, 2013. The presentation focused on erosion and sedimentation control issues with Low Impact Development treatment systems.
- Steve presented two papers at the **2013 Environmental Connection** held in San Diego, CA on February 10 – 13, 2013. The papers are entitled “LID Demonstration Project for Seaside Village in Bridgeport, Connecticut” and “Creating a Stormwater Park in the City Meadow of Norfolk, Connecticut”. He also presented a full day LID workshop entitled “Next Generation Low Impact Development and Meet Today’s Needs” and a half day workshop on Low Impact Development

covering Environmental Site Design, Water Quality Issues, Pollutant Loading Analyses, Designing different types of LID treatment systems and actual case studies.

- Steve made three presentations at the **2012 Annual Conference of the Northeast Chapter of IECA** in Fishkill, NY on November 7, 8, & 9, 2012. The presentations are entitled: “LID Demonstration Projects in Connecticut, A Study of Contrasts, Environmental Site Design and LID Hydrologic Issues, and Siting and Designing LID Treatment Systems with Case Studies”
- Steve made two oral presentations entitled “Applying Environmental Site Design Strategies to Design a Residential Subdivision” and “The incorporation of LID on Affordable Housing Projects” at the **2012 Ohio Stormwater Conference** in Toledo, Ohio sponsored by the Ohio Stormwater Association on June 7<sup>th</sup> and 8<sup>th</sup>, 2012.
- Presented two papers at the **ASABE Watershed Technology Conference** in Bari, Italy, May 28 – 30, 2012. The papers were entitled “LID Demonstration Project for Seaside Village in Bridgeport, Connecticut” and “The creation of a Stormwater Park in the City Meadow of Norfolk, Connecticut”.
- Steve made one oral presentation entitled “LID Demonstration Project for Seaside Village in Bridgeport, Connecticut” and presented one poster entitled "The Incorporation of LID on Affordable Housing Projects" at the **2012 World Environmental & Water Resources Congress** in Albuquerque, New Mexico sponsored by EWRI/ASCE on May 20 - 24, 2012.
- “Stormwater Retrofit of Highwood Estates Detention basins to address Water Quality Issues and How the application of Environmental Site Design Strategies can provide a resource for carbon sequestering” were presented at the **2011 International Erosion Control Associated Northeast Chapter Annual Conference** on December 1 – 3, 2011 at the Crowne Plaza Hotel in Natick, Massachusetts.
- Stormwater Retrofit of Highwood Estates Detention Basins to enhance Water Quality Benefits: A Low Impact Development (LID) Model Ordinance and Guidance Document and The Farmington River Enhancement Grants: A tale of three towns and the path to Low Impact Development were presented at the **Philadelphia Low Impact Development Symposium “Greening the Urban Environment”** in Philadelphia, PA (September 2011) sponsored by EWRI, Villanova University, North Carolina University and the University of Maryland.
- Stormwater Retrofit of Highwood Estates Detention Basins to enhance Water Quality Benefits; The Farmington River Enhancement Grants: A tale of two towns and the path to Low Impact Development and A Low Impact Development (LID) Model Ordinance and Guidance Document was presented at the **EWRI/ASCE 2011 World Environmental & Water Resources Congress** in Palm Springs, CA (May 2011).
- Stormwater Retrofit of Highwood Estates Detention Basins to enhance Water Quality Benefits was presented at the “Annual Nonpoint Source Pollution Conference”, sponsored by the **New England Interstate Pollution Control Commission** in Saratoga Springs, NY, on May 17-18, 2011.
- Stormwater Pollutant Load Modeling presented at the **Northeast Chapter of IECA Annual Conference** at the University of New Hampshire Stormwater Center in Durham, NH (December 2010).

- How the application of Environmental Site Design Strategies and Low Impact Development Storm Water Treatment Systems can mimic the Natural Hydrologic Conditions in a watershed and provide a resource for carbon sequestering and The Importance of Assessing Pollutant Loads from Land Development Project and the Design of Effective Storm Water Treatment Systems at the **EWRI/ASCE Watershed Management Conference** in Madison, WI (August 2010).
- The Tolland Low Impact Development Design Manual: The Changing Paradigm for Land Development, The application of Environmental Site Design Processes to design a residential subdivision and A Low Impact Development (LID) Model Ordinance and Guidance Document at the **EWRI/ASCE 2010 World Environmental and Water Resources Congress** in Providence, RI (May 2010).
- The application of Form-Based Zoning and Low Impact Development for the Revitalization of the Town Center of Simsbury, Connecticut and The Integration of Low Impact Development to enhance the application of Smart Code Zoning to create a Gateway District to the Historic Town Center of Tolland, Connecticut at the **EWRI/ASCE 2010 International Low Impact Development Conference** in San Francisco, CA (April 2010).
- The application of Environmental Site Design Processes to design a residential subdivision and Assessing Pollutant Loads and Evaluation of Treatment Systems to achieve Water Quality Goals for Land Development Projects at the **EWRI/ASCE 2009 World Environmental & Water Resources Congress** in Kansas City, Missouri (May 2009).
- Ahead of the Curve – Tolland, CT adopts Low Impact Development Regulations and Preparing a Pollutant Loading Analysis for Land Development Projects at the **Urban Water Management Conference** in Overland Park, KS sponsored by National Association of Clean Water Agencies (NACWA) and the City of Independence Water Pollution Control Department (March 2009).
- Ahead of the Curve – Tolland, Connecticut adopts Low Impact Development Regulations and Trade Winds Farm – Winchester, Connecticut – How to create a LID subdivision along with the preparation of a poster on Preparing a Pollutant Loading Analysis for Land Development Projects at **EWRI/ASCE 2008 International Low Impact Development Conference** in Seattle, WA (November, 2008).
- Trade Winds Farm – Winchester, Connecticut – How to create a LID subdivision and Preparing a Pollutant Loading Analysis for Land Development Projects at the **IECA Northeast Chapter’s Annual Conference & Trade Exposition** in Portland, ME (October, 2008).
- The Preparation of a Valid Pollutant Loading Analysis at the **National StormCon 2008 Conference** in Orlando, FL (August, 2008).
- Panelist with Linda Farmer, AICP for Profiles of Partnerships for Addressing NPS Pollution at **NEIWPC Annual Non-point Source Pollution Conference** in Groton, CT (May, 2008).

### **Workshop Presentations:**

- Steve presented a full day workshop on “Stormwater Regulations in Connecticut”, sponsored by Halfmoon Seminars, LLC in North Haven, Connecticut on June 25, 2014. More than 30 engineers and landscape architects attended the workshop.

- Steve was the facilitator in a live chat as part of the Stormwater Solutions Virtual Trade Show on April 2, 2014. The topic of the live chat will be LID with a focusing on Bioretention systems.
- Steve made a presentation entitled “What is Low Impact Development and how do you apply it to residential projects” for the Connecticut Chapter of the American Institute of Architects in New Haven, Connecticut on April 22, 2014.
- Steve made a presentation entitled “Wastewater to Stormwater; Designing a subsurface flow gravel wetlands” at the annual meeting of the Connecticut Association of Wetland Scientists on March 20, 2014 in Southbury, Connecticut.
- Steve made a presentation entitled “Low Impact Development and the Connecticut General Stormwater Permit” at the annual meeting of the Southern New England Chapter of the Soil and Water Conservation Society on March 14, 2014 at Eastern Connecticut State University.
- He co-taught an ASCE Short Course entitled, “Introduction to Low Impact Development” with Mike Clar at the 2013 Low Impact Development Symposium held in St. Paul, Minnesota on August 18, 2013.
- Steve presented a workshop on Low Impact Development to the Town of Naugatuck Inland Wetlands Commission on June 5, 2013 to demonstrate how the implementation of LID can reduce stormwater impacts in the urban area of the community.
- Steve presented a webinar entitled “The Basics of Low Impact Development on Wednesday, April 17, 2013. More information is available at <http://www.ieca.org/education/webinar/livewebinars.asp>
- Steve presented a webinar entitled “Changing the Regulatory Framework to Adopt LID Strategies” on Thursday, March 7, 2013 and on Thursday, August 8, 2013 from 11:30 am to 1:00 pm through **ASCE and EWRI**. Link for more information: <http://www.asce.org/Continuing-Education/Brochures/Webinars/ChangingRegulatoryFrameworkLIDStrategies/#Purpose>
- Steve presented a three hour workshop on Low Impact Development on June 5, 2012 at the Oxford town hall for municipal land use staff and officials at the request of the **Oxford Inland Wetlands and Watercourses Commission**. Approximately 20 individuals attended the workshop.
- Steve presented an eight hour short courses on Low Impact Development at the **EWRI/ASCE 2011 World Environmental & Water Resources Congress** in Palm Springs, CA (May 2011). The following topics will be covered: Understanding and Implementing Principles of Low Impact Development, Applying LID Strategies to a Site, Low Impact Development Hydrologic Considerations, The Regulatory Framework and LID, LID Integrated Management Practices, Erosion and Sedimentation Controls for the Implementation of LID Practices and Case Studies (Applying LID and Regulations). 12 attendees took the course, including professors from Mississippi State University, Oklahoma State University, Adelaide University (Australia) and Pusan National University (South Korea).
- Understanding and Implementing Principles of Low Impact Development, Applying Low Impact Development to a Site, Low Impact Development Hydrologic Considerations, Low Impact Development Integrated Management Practices, Erosion and Sediment Control for the Implementation of Low Impact Development Practices, and Case Studies of LID (Residential and

Commercial) at workshops on Low Impact Development sponsored by **HalfMoon, LLC** (<https://www.halfmoonseminars.com>) in Albany, NY, Ronkonkoma, NY, North Haven, CT, Manchester, NH, Nanuet, NY, Cleveland, OH, Natick, MA, Portland, ME Fort Washington, PA, Springfield, MA, Wilmington, DE, White River Junction, VT, Somerset, NJ, and White Plains, NY for continuing education credit for design professionals. A total of 322 land use professionals have attended these workshops.

- Pollutant Loads and the Design of Effective Stormwater Treatment Systems was presented at the Virtual H2O conference on February 22, 2011 as presented by **PennWell Publishing**. 25 professionals in attendance.
- LID Stormwater Treatment Systems: Siting, Design and Installation for Maximum Environmental Benefit. What are the aesthetic, financial and maintenance implications? presented at a seminar for the **AIA Connecticut, Committee on the Environment** in New Haven, CT (December 2010). 70 architects in attendance.
- Low Impact Development and the Environmental Site Design process to create sustainable sites at a seminar for the **AIA Connecticut, Committee on the Environment** in New Haven, CT (September 2010). 40 architects in attendance.
- Workshop entitled Using Environmental Site Design Strategies and LID stormwater systems for commercial development at the **Connecticut Conference on Natural Resources** at the University of Connecticut (March 2010). 10 design professionals and regulatory staff in attendance.
- Implementing Low Impact Development in Your Community for the **Connecticut Technology Transfer Center** in Glastonbury, CT (November, 2009). 40+ professionals in attendance.
- What towns can do to encourage LID at the “Low Impact Development Forum” presented by the **Housatonic Valley Association** in Shelton, CT. (October 2009). 12 professionals in attendance.
- Town of Tolland, CT; Low Impact Development Regulations and Design Manual at the **Community Builders Institute** for the workshop entitled: “Swift, Certain & Smart: Best Practices in Land Use” (May 2009). 30+ professionals in attendance.
- Low Impact Development, Environmental Site Design and Water Quality issues and strategies to local municipalities (**Greenwich, and Old Lyme**) to provide an educational opportunity about the many benefits of Low Impact Development in 2009. 30+ design professionals, regulatory commissioners and staff in attendance for each presentation.
- Low Impact Development, Environmental Site Design and Water Quality issues and strategies to local municipalities (**Bolton, Farmington, and Guilford** to date) on a pro bono basis to provide an educational opportunity about the many benefits of Low Impact Development in 2009. 25+ design professionals, regulatory staff and commission members in attendance for each presentation.
- Workshop entitled Using Environmental Site Design Strategies to create a residential subdivision at the **Connecticut Conference on Natural Resources** at the University of Connecticut (March 2009). 20 design professionals and regulatory staff in attendance.
- The Need for Pollutant Loading Analyses for Land Development Projects to storm water engineers at **CT DEP** (March 2009). 6 DEP staff in attendance.

- A review of existing land use regulations and storm water management issues for the Middle Quarter Districts in Woodbury, CT and how the implementation of Environmental Site Design and Low Impact Development strategies can improve water quality of storm water runoff for the Woodbury land use agencies (August 2008). 15 regulatory commission members in attendance.
- Low Impact Development at meeting of the **Connecticut Association of Zoning Enforcement Officers** (October 2007). 30+ professionals in attendance.
- Low Impact Development and adoption of LID regulations by municipalities at workshops of the **Land Use Leadership Alliance (LULA)** (2007, 2010 and 2011). 20+ professionals in attendance at each presentation.
- Stormwater management and Low Impact Development at workshop sponsored by the **Northwest Conservation District** held for land use officials (March 2006). 20+ professionals in attendance.



## **LOW IMPACT SUSTAINABLE DEVELOPMENT PROJECTS**

### **LID Regulations and Design Manuals**

- **Town of Tolland, CT** – Prepared amendments to Town of Tolland Zoning, Subdivision, Inland Wetland regulations and Road Design Manual to incorporate Low Impact Development standards. Wrote “Design Manual – Low Impact Development – Storm Water Treatment Systems – Performance Requirements – Road Design & Storm Water Management” prepared for the Town of Tolland; October 2007. The Town of Tolland was awarded the Implementation Award by the CT-APA for the LID regulations and design manual in December 2008.
- **Town of Plainville, CT** – Planimetrics was the lead consultant on this project. This office performed the technical regulatory audit to identify barriers to the implementation of LID. These barriers were removed from the regulations to provide for the implementation of LID. A LID design manual was written by Steve Trinkaus to address specific development/stormwater issues for the Town of Plainville. The regulatory changes and LID manual were adopted by the Planning and Zoning Commission in September 2010. This work was funded by the Farmington River Enhancement Grants from CT DEP.
- **Town of Harwinton, CT** – In conjunction with Planimetrics of Avon, CT, the existing land use regulations were evaluated for barriers to the implementation of Low Impact Development (LID). The project team suggested changes to the land use regulations to encourage the application of LID in the community. Steve Trinkaus defined design processes and strategies to encourage the implementation of LID in the town. This work was funded by the Farmington River Enhancement Grants from CT DEP.

- **Town of East Granby, CT** – Planimetrics was the lead consultant on this project. This office performed the technical regulatory audit to identify barriers to the implementation of LID. These barriers were removed from the regulations to provide for the implementation of LID. Steve Trinkaus prepared a LID Design Manual and LID Educational document for the town working with Gary Haynes, the town planner. This work was funded by the Farmington River Enhancement Grants from CT DEP.

## **LID Projects**

- **Jelliff Mill, LLC** – New Canaan, Connecticut: Redesigned the site layout to create ten single family residential units on a site overlooking the restored historic Jelliff Mill dam on the Noroton River. The site design uses two sections of permeable pavement and a Bioretention system to infiltrate the runoff from the proposed impervious areas on the site. Due to the presence of sand and gravel soils, all runoff from the impervious areas will be infiltrated up to and including the 25-yr storm event (5.7” of rain/24 hrs).
- **SRG Family, LLC** – Southbury, Connecticut: Design final site grading for 32,000+ sq.ft. medical services building and approximately 160 parking spaces in order to maintain overland flow patterns. Design multiple LID treatment systems consisting of bioswales with weirs and Bioretention systems to handle runoff from all impervious area on the project site. The LID treatment systems are capable of fully infiltrating the runoff from a 50-yr storm event will virtually eliminating the discharge of any pollutants to the adjacent wetland area. Approved by Inland Wetlands Commission.
- **Garden Homes Management** – Southport, Connecticut: Designed site to support 96 unit apartment building and 115 parking spaces. Site contains both freshwater and tidal wetlands. Stormwater management design required to provide Groundwater Recharge Volume & Water Quality Volume in addition to reducing the post-development peak rate of runoff from the 10-yr rainfall event to the pre-development peak rate of runoff from the 2-yr rainfall event. The stormwater management design includes grassed swales, Bioretention systems and underground concrete galleries to meet all of these stormwater requirements. Due to favorable soils on the site, the site will likely be a zero discharge site. Currently under regulatory review.
- **Garden Homes Management** – Milford, Connecticut: Designed site to support 257 unit apartment building with 295 parking spaces. Stormwater management design required to provide Groundwater Recharge Volume & Water Quality Volume in addition to reducing the post-development peak rate of runoff from the 25-yr rainfall event to the pre-development peak rate of runoff from the 25-yr rainfall event. The design utilizes a Bioretention system, two underground galleries systems as well as a small detention basin to meet all of the stormwater requirements.
- **Garden Homes Management** – Milford, Connecticut: Designed site to support 21,888 sq.ft. building (three stories) containing 36 studio apartments and 45 parking spaces. Permeable pavement and Bioretention will be used on the site to treat runoff for water quality improvements along with reducing runoff volume from the 1-yr to 100-yr storm event. Construction complete and project ready for occupancy.
- **Quickcomm, Inc.** – Newtown, CT: Design a parking facility for approximately 140 vehicles to serve an existing corporate use. Runoff from the entire parking facility will be directed to one of seven Bioretention systems. Water quality of the runoff will be improved by the filtration through a specialized soil media and will then infiltrate into the underlying soils. Due the presence of sand and

gravel soils, the Bioretention systems will fully infiltrate all runoff up to and including a fifty-year design storm (6.5" of rain/24 hours). Land use approvals obtained in the Fall of 2012 and work completed in the Fall of 2013..

- **Garden Homes Management** – Fairfield, Connecticut: Designed site to support 32,592 sq.ft. building (three stories) containing 54 studio apartments and 68 parking spaces. Permeable pavement will be used for majority of parking facility. Roof drains will also be directed to permeable pavement system for water quality improvement. Reservoir layer was sized to fully contain 1.7" of runoff from contributing impervious area. By using a raised underdrain an anaerobic condition will be maintained in the bottom of the reservoir, thus providing denitrification of Total Nitrogen prior to discharge to tidal section of Rooster River. Construction complete and project ready for occupancy.
- **Garden Homes Management** – Oxford, Connecticut: Design site plan for 126 units of manufactured housing on 41+ acres. Stormwater management is achieved by the use of linear Bioretention systems along both sides of all interior roads. Permeable pavement was used for approximately 900 lf of the road network. Large Bioretention systems with Internal Water Storage zones will be used to infiltrate and treat runoff in two locations on the site where suitable soils exist. Water quality of the post-development runoff will also be addressed by Construction Wetland Treatment systems in addition to the linear Bioretention systems. Approved by Inland Wetlands Agency, Denied by Planning and Zoning Commission. Currently under legal appeal in court.
- **Compton Family Trust** – New Hartford, Connecticut: Design two wet swales systems to convey and filter runoff from road which is currently discharged into West Hill Lake via a paved swale. West Hill Lake has very good water quality and the owner desires this work on this property to become a template for other homeowners on West Hill Lake to prevent adverse impacts of stormwater on the water quality of the lake. Received all necessary land use approvals. Construction to commence in the summer of 2012.
- **Highwood Estates** – Thomaston, Connecticut: Design retrofits for two existing failing detention basins serving existing 50 lot residential subdivision. Retrofits were designed using LID techniques to improve water quality reaching Northfield Brook, an impaired waterway. The larger basin was converted to an Extended Detention Shallow Wetlands to significantly reduce pollutant loads. Due to a limited area, only a forebay and deep pool could be designed for the smaller basin, thus providing measurable improvements in water quality.
- **Farmington River Watershed Association** – Winchester, Connecticut: Design stormwater retrofits consisting of a Bioretention system at the Town of Winchester Wastewater Treatment Plant and a Bioswale at the Town of Winchester Public Drinking Supply facility. These projects are being funded as LID demonstration projects to increase public awareness of LID. The systems were installed in June 2012 and were featured in articles in the Republican American and Register Citizen newspapers.
- **Harwinton Sports Complex** – Harwinton, Connecticut: Redesign stormwater management system for indoor sports facility to use vegetated swales and Bioretention systems. Redesign site grading to eliminate all structural drainage in parking facility. Client saved over \$ 40,000 on infrastructure costs by the use of LID treatment systems.
- **Holland Joint Venture, LLC** – Bridgewater, Connecticut: Prepared site plan for 28,000 sq.ft. industrial/light assembly use and 140 parking spaces on 10.94 acres. Utilize Environmental Site Design strategies to preserve large portions of site in natural condition, minimize impacts due to site

disturbance, and minimize impacts to wetland/watercourse system by access driveway. Designed five Bioretention systems for storm water management and pollutant removal from all impervious areas.

- **Goodhouse Flooring, LLC** – Newtown, Connecticut: Design site to accommodate 8,800 commercial building and associated driveway and parking areas on 1.0 acre site. Designed eight Bioretention systems to handle runoff from all impervious surfaces. Analyze and demonstrate that State of Connecticut water quality goals will be achieved for the site design.
- **Trade Winds Farm** – Winchester, Connecticut: 24 lot Open space subdivision on 104+ acres of land. Performed all civil engineering design work for project. Notable feature of project is the preservation of 64+ acres of the site as dedicated Open Space. Many LID strategies such as Environmental Site Design, site fingerprinting, volumetric reduction and water quality improvements were incorporated into site design. Storm water treatment systems utilized vegetated basins, vegetated swales with gravel filter berms, emergent marsh, Bioretention systems, linear vegetated level spreader, and meadow filter strips.
- **Northern View Estates** – Sherman, Connecticut: Five lot subdivision with private road. Design has no direct wetland impacts and only minor intrusions into defined 100' upland review area. Low Impact Development systems, such as vegetated swales and Bioretention were used to treat post-development runoff while maintaining existing drainage patterns to the maximum extent possible.
- **Mill River** – New Milford, Connecticut: Designed 14 lot open space subdivision on 68 acre site. Performed all civil engineering services for project. LID treatment systems such as a permanent pond/emergent marsh system, linear biofiltration swale, and rain gardens were designed for the site.
- **Byron Avenue Cluster Development** – Ridgefield, Connecticut: Seven lot cluster subdivision on 4 acres. The Stormwater management system consisted of a road with no curbs, grassed swales and constructed wetland with detention to reduce pollutant loads and increases in the peak rate of runoff.
- **The Estates on the Ridge** – Ridgefield, Connecticut: 32 lot open space subdivision on 152+ acres. Over 80 acres of the site will be preserved as Open Space as part of this project. Stormwater will be treated by the use of rain gardens for roof drains, infiltration trenches for footing drains, emergent marsh systems and vegetated swales for conveyance and treatment of road runoff. Designed over 1 mile of proposed road for project. Designed bottomless culverts over several wetlands crossing to minimize direct impact on wetland areas.
- **Garden Homes Management – Oxford Commons** – Oxford, Connecticut: Designed 113 unit affordable housing plan with no wetland impacts. Stormwater management used grassed conveyance swales along curbless roads, multiple constructed/vegetated wetland systems, vegetated level spreaders and infiltration galleries for pollutant removal and reductions of peak rates of runoff.
- **G & F Rentals, LLC** – Oxford, Connecticut: By utilizing LID stormwater concepts such as grass filter strips, Bioretention in parking islands, Bioretention for roof drains, and infiltration trenches, a total of 54,000 sq.ft. of commercial office space along with 140+ parking spaces was placed on 10 acre site. The project also restored previously degraded inland wetlands on the site.
- **Dauti Construction – Edona Commons** – Newtown, Connecticut: Designed 23 unit affordable housing plan to minimize impacts on delineated wetland areas. Designed three construction wetland systems for the treatment of storm water runoff for water quality renovation.

- **American Dimensions, LLC** – New Milford, Connecticut: Redesigned the storm water treatment systems for a 7 lot residential subdivision. Rain gardens were designed to handle the runoff from all roof areas and proposed driveways. Each rain garden provided the required Water Quality Volume and Groundwater Recharge Volume as specified in the 2004 Storm Water Quality Manual. A Subsurface Gravel Wetland was designed to treat the full Water Quality Volume for runoff from adjacent roads network which drained through the subject property.
- **Molitero Residence** – New Fairfield, CT: Designed five Bioretention systems to mitigate both volumetric increases of runoff and address water quality issues for large building addition to single family residence on Candlewood Lake. Also designed landscape filter strip above lake edge to filter runoff from upgradient lawn area. Bioretention systems fully infiltrated 5” of rain in 24 hours from Hurricane Irene in August of 2011. Project was featured in newsletter of Candlewood Lake Authority to demonstrate the effectiveness of LID treatment systems in a lake environment.
- **Multiple single family residences** – Design Bioretention systems to mitigate volumetric increases of runoff due to increases of impervious cover on the lot for large building additions and new construction including the reduction of volumetric increases up to the 25-yr event (5.7” of rain in 24 hours).

### **Residential Subdivisions**

- **Stone Ridge Estates**, 59 lot residential open space subdivision, Ridgefield, Connecticut (Town of Ridgefield)
- **Oak Knoll**, 14 lot open space subdivision, Ridgefield, Connecticut (Mike Forbes)
- **Ward Acres Farm**, 12 lot open space subdivision, Ridgefield, Connecticut (Sturges Brothers, Inc.)
- **Horblitz Subdivision**, 13 lot open space subdivision, Ridgefield, Connecticut (John Sturges)
- **McKeon Subdivision**, 14 lot conventional subdivision, Ridgefield, Connecticut (McKeon Family Trust)
- **High Ridge Estates**, 5 lot subdivision in historic district, Ridgefield, Connecticut (Scandia Construction)
- **Millstone Court**, 7 lot conventional subdivision, Ridgefield, Connecticut (Sturges Brothers, Inc.)
- **Cricklewood Subdivision** – 12 lot conventional subdivision, Redding, Connecticut (Jay Aaron)
- **Spruce Meadows Subdivision** – 12 lot conventional subdivision, Wilton, Connecticut (Piburo Builders)
- **Noroneke Estates** – 12 lot open space subdivision, Ridgefield, Connecticut (John Sturges)
- **Lynch Brook Lane** – 7 lot open space subdivision, Ridgefield, Connecticut (Sturges Brothers, Inc.)
- **Ledgebrook Subdivision** – 27 lot conventional subdivision, Southbury, Connecticut (Conte Family Trust, LLC)
- **Seven Oaks** – 19 lot open space subdivision, Ridgefield, Connecticut (Basha Szymanska)
- **Applewoods** – 29 lot conventional subdivision, Bethel, Connecticut (Gene & Joe Nazzaro)

### **Commercial Site Plans**

- **Cannondale Corporation Headquarters** - Bethel, Connecticut
- **Village Bank Headquarters** – Danbury, Connecticut
- **Newtown Hardware** - Newtown, Connecticut
- **Amicus Healthcare Living Centers** – Rocky Hill, Connecticut
- **Nathan Hale Office Building** – Fairfield, Connecticut

- **Ridgefield Recreation Center** – Ridgefield, Connecticut
- **Silver Spring Country Clubhouse & Pool house renovations** - Ridgefield, Connecticut
- **Tiger Hollow Athletic Complex at Ridgefield High School** - Ridgefield, Connecticut

### On-site sewage disposal systems

- **Candle Hill Mobile Home Park** – Design Subsurface Sewage Disposal Systems for individual mobile home units. New Milford, Connecticut.
- **Hemlock Hills Camp Resort** – Expansion of campground, design of gravity sanitary sewer and design of subsurface sewage disposal system to handle 4,800 gpd. Litchfield, Connecticut.
- **Old Field Condominiums** – long term inspection & reporting on the condition of multiple subsurface sewage disposal systems serving 40 unit condominium complex with design flows in excess of 15,000 gpd. Southbury, Connecticut.
- **Thorncrest Farm** – Design of on-site sewage disposal system to handle wastewater from milking operation. Goshen, Connecticut.
- **Silver Spring Country Club** – Design of multiple subsurface sewage disposal systems for private country club with average daily flow of 7,000 gpd during peak usage season.
- **Richter Park Golf Course** – Design subsurface sewage disposal system to replace existing failed system for golf club house and year round restaurant with average daily flow of just under 5,000 gpd.
- **Redding Country Club** - Performed soil testing to design a repair to an existing wastewater management system that was experiencing periodic effluent discharges during high use on very marginal soil conditions. Utilized oversized grease tanks for kitchen waste and septic tanks to increase the clarity of the effluent which was discharged by force main to the subsurface sewage disposal system increase the long term functionality of the system. Discharge rate 4,900 gpd.

### General Civil Engineering Projects

- **Montgomery Residence**, 10,000 sq.ft. residence with 2.5 acre pond, Redding, Connecticut.
- **Neils Different**, Design 1 acre pond, Ridgefield, Connecticut.
- **Anthony DeLuca**, Design 2 acre pond, Redding, Connecticut.
- **Barrett Cram**, Design 0.5 acre pond, Redding, Connecticut.
- **Jay & Eileen Walker Residence**, 27,000 sq.ft. residence, Ridgefield, Connecticut.
- **Groton Open Space Association** – third party engineering review – Wal-Mart Super center, Mystic Woods Age Restricted Development, and changes to stormwater standards in the Town of Groton regulations – Groton, Connecticut.
- **Tolland Planning & Zoning Commission** – third party engineering review – Star Hill Athletic Complex with focus on water quality impacts on existing impaired waterway.
- **Newtown Inland Wetlands Commission** – third party engineering – Sherman Woods – 38 lot residential Subdivision with focus on stormwater management and water quality.
- **Winchester Inland Wetlands Commission** – third party engineering review of 30,000 sq.ft. commercial building with grading and stormwater management within 100-yr flood plain.
- **Southbury Inland Wetlands Commission** – third party engineering review of 20,000 sq.ft. medical office building proposed in close proximity to inland wetlands & watercourses.

### Athletic Facilities

- **Kingdome** – East Fishkill, NY, Prepare comprehensive site plan for the construction of an air-supported structure covering 7.96 acres of land area. Project also includes the design of 303 parking

spaces, two full size artificial turf baseball fields and three 54-80 artificial turf baseball fields. Designed all site grading and stormwater management facilities to address water quality volume, channel protection volume as well as peak rate attenuation for the 1-yr, 2-yr, 10-yr, 25-yr, 50-yr and 100-yr rainfall events.

- **Tiger Hollow – Ridgefield High School – Phase I**, Design and site artificial turf competition field and track complex. Design access road to provide access to new building containing locker rooms, concessions, media room, and equipment storage areas. Design all utility connections and obtain local permits.
- **Tiger Hollow – Ridgefield High School – Phase II**, Prepare Conceptual Development plan for reconfiguration of existing athletic fields adjacent to the Tiger Hollow stadium.
- **Joel Barlow High School – Redding, CT**, Provide preliminary Master Plan on pro bono basis for reconfiguration and improvement of existing athletic fields at Joel Barlow in response to Falcon Pride stadium proposal. Plan was provided to Region 9 Board of Education for general discussion purposes.