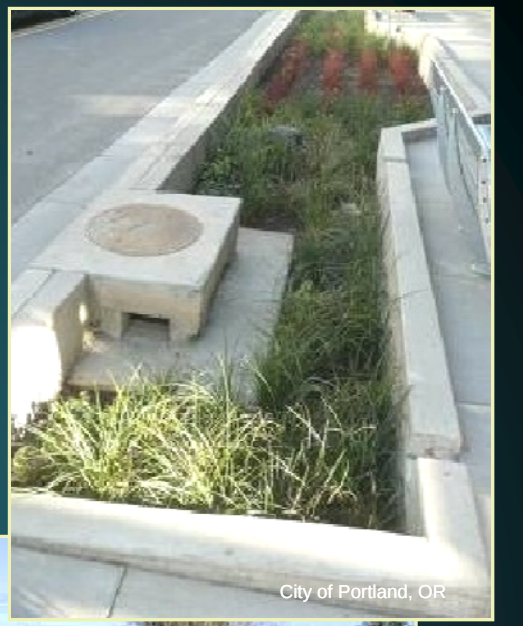
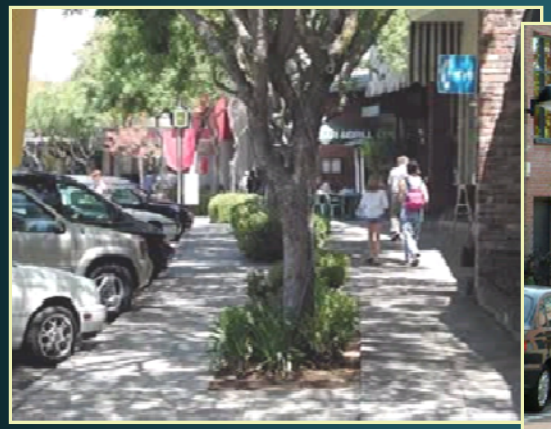
Reconciling Green Infrastructure Implementation Challenges:

Case Studies and Local Experience


City of Portland, OR




City of Seattle, WA

Ellen Hahn, Stormwater Specialist
New York State Department of Environmental Conservation

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Central New York Regional Planning & Development Board

Changes in Stormwater Design

- Revised (2010) NYS Stormwater Management Design Manual
  - New process using low impact design and green infrastructure: **"Runoff reduction"**
    - Reduce runoff generated or manage it at or near the source
  - Required for all projects for which the NOI is received in Albany March 1, 2011 or later
    - Exception: Projects with completed SWPPPs that applied for local government approvals prior to 3/1/11

Changes in Stormwater Design

- The Old Way
  - End-of-pipe treatment typical
    - Stormwater managed downstream of its source
  - Large practices used for water quality and quantity control
    - Ponds, wetlands, infiltration basins, etc.
  - Use of engineered structures rather than natural processes

Changes in Stormwater Design

- The New Way
  - Reduce Contributing Area
    - Lessen impervious area
    - Reduce footprint
    - Avoid disturbance of natural areas
  - Reduce Contributing Volume
    - Assimilate runoff near source using green infrastructure
    - Mimic natural processes for stormwater management
    - Fewer ponds and closed drainage systems
  - Preserve existing drainage patterns
    - Allow natural topography to drive layout of project


Randall Arendt, 1996

Challenges: Codes

- Conflicts with existing codes
  - State and local regulations limit the options
  - Developers will request practices previously not proposed
    - Developer wants to move the project forward while complying with Construction permit
    - MS4 must comply with MS4 Permit and their own codes
    - Flexibility and compromise necessary
    - Changes to codes may be warranted

Challenges: Maintenance

- Maintenance issues
  - Small-scale practices (e.g. rain gardens, planters) on private property
  - Need numerous agreements with individual property owners
  - Unmanageable number of easements
  - Difficult to establish easements when practice location is not known until after building construction
  - Highway departments not familiar with practices or how to maintain them

Challenges: Funding

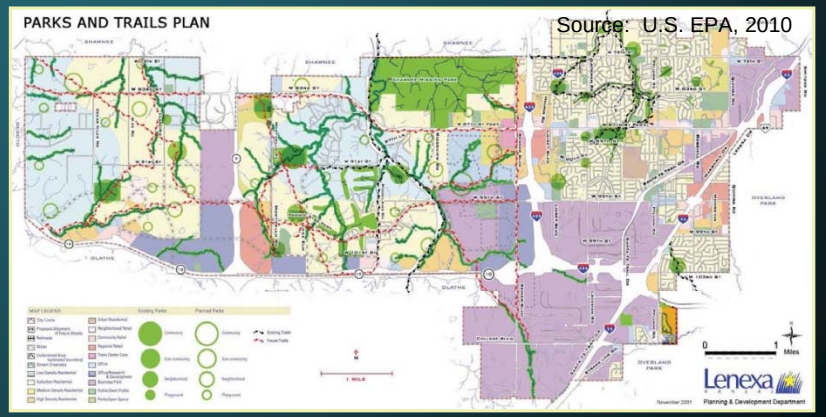
- Permit Fees
  - One-time payment does not ensure sustainable funding for maintenance in a given development
- Drainage Districts
  - Consolidated or independent (drawbacks to both)
  - Necessitate municipal control of all practices
  - Resource-intensive system with large staff commitment
- No enacting legislation for formation of stormwater utilities in NYS
  - Can't create incentives to reduce impervious, disconnect downspouts, etc.
  - Can't establish equitable system to fund post-construction stormwater program

Case Study: Lenexa, Kansas

- Growing suburb of Kansas City
- Vision 2020 Comprehensive Plan developed in 2001
  - Initiated “Rain to Recreation” program
- Integrated Stormwater and Watershed Management Master Plan
  - Correct existing problems in developed areas
  - New facilities to minimize runoff
  - Protect undeveloped lands
- Uses regulatory approaches as well as major capital projects and land acquisitions

Case Study: Lenexa, Kansas

- Adopted post-construction stormwater ordinance
  - Ranks different practices for their performance in improving water quality
- Water quantity problems addressed through large capital improvement projects
- City purchases land in priority areas to provide
  - Flood mitigation
  - Stream protection
  - Water quality improvement
  - Recreational amenities



Case Study: Lenexa, Kansas

- Funding
  - Small sales tax to support building stormwater facilities
  - Stormwater utility for sustainable funding
  - Systems Development Charge –


Source: U.S. EPA, 2010

- Requires new developers to pay fee to recover costs for capital improvements ("in-lieu" fee for green infrastructure)
- City manages water quantity from new impervious surfaces

Case Study: Emeryville, California


Source: U.S. EPA, 2010


Source: U.S. EPA, 2010

- Declining industrial city ripe for redevelopment
- Developed comprehensive set of stormwater policies and guidelines adapted to unique conditions
  - Minimize impervious area
  - Include vegetative stormwater controls
- These green infrastructure strategies were introduced to municipal code in 2007
- Address life span of practices, from design to maintenance

Case Study: Emeryville, California

- Significant challenges to use of green infrastructure (limited infiltration opportunities)
  - High water table – risk to groundwater
  - Dense development patterns
  - Predominance of clay soils
  - Compaction and contamination of soils
- Two main strategies to address challenges
  - Innovative parking solutions to reduce runoff
    - Reduce number of parking spaces based on demand
  - Infiltrate, evapotranspire, and harvest/reuse rainwater while adapting to space constraints

Case Study: Wilsonville, Oregon

- Rapidly growing suburb of Portland
- Updated comprehensive plan to address future urban expansion and stormwater system needs
  - Outlines measures to protect natural areas and introduce new green infrastructure elements
  - Emphasizes measures that improve groundwater infiltration, habitat value, and aesthetics
    - Maintain or restore natural drainage patterns
    - Preserve or improve native vegetation

Case Study: Wilsonville, Oregon

- Completed pilot project to test feasibility of various green infrastructure practices
  - 500-acre mixed use development used as testing ground
  - Developer monitored effectiveness of practices
    - Porous pavement
    - Stormwater planters
    - Bioretention
    - Ecoroofs
  - Allowed City to determine how these approaches integrated with City and State development codes


Source: U.S. EPA, 2010

Case Study: Wilsonville, Oregon

- System development charges and user fees are collected to fund these improvements
  - Developers pay fee before obtaining building permit
  - Revenues used to implement large capital projects


Source: U.S. EPA, 2010

- Green streets curb extensions
- Stream restorations
- Other investments supporting natural drainage

Case Study: Cleveland Heights, OH

- Completed a sustainability audit of their zoning codes – goals include
  - Reduce impervious surface
  - Increase tree and vegetation coverage and bio-diversity
- Residential district codes examined to identify provisions that encumber:
  - Lot limitation on impervious surface (maximum coverage)
  - Ability to offset impervious with porous pavement, rain gardens, etc.
  - Preservation of open space

Case Study: Cleveland Heights, OH

- Performance-based standard for on-site stormwater management requirements
- Post-development runoff rate must meet pre-development rate
  - Cannot exceed 50% of the pre-development runoff rate for redevelopment projects
- All new construction must capture the first inch of rainwater on-site

Case Study: Cleveland Heights, OH

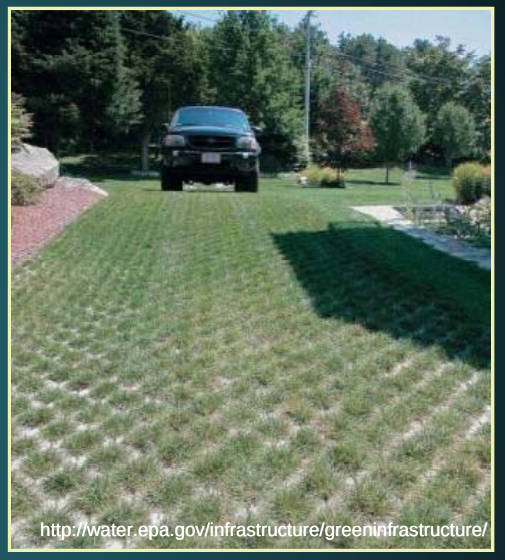

http://www.lid-stormwater.net/raincist/raincist_benefits.htm


http://water.epa.gov/infrastructure/greeninfrastructure/

- Overall recommendations
  - Modify codes to allow rain gardens, water harvesting systems with screening, and green roofs
  - Require vegetated buffers between adjacent incompatible land uses and street trees in medians
  - Protection of riparian corridors using overlay district
  - Tree removal and replacement regulations

Case Study: Cleveland Heights, OH

- Overall recommendations (ctd.)
  - Promote use of pervious pavement in parking lots, require use for lots over a threshold size
  - Reduce both maximum and minimum parking requirements
  - Develop flexible arrangements for shared parking
  - Offer incentives for use of green infrastructure for large developments
    - Density bonuses
    - Flexibility in zoning and design


http://water.epa.gov/infrastructure/greeninfrastructure/


Source: U.S. EPA

Case Study: Olympia, Washington


Source: U.S. EPA, 2010

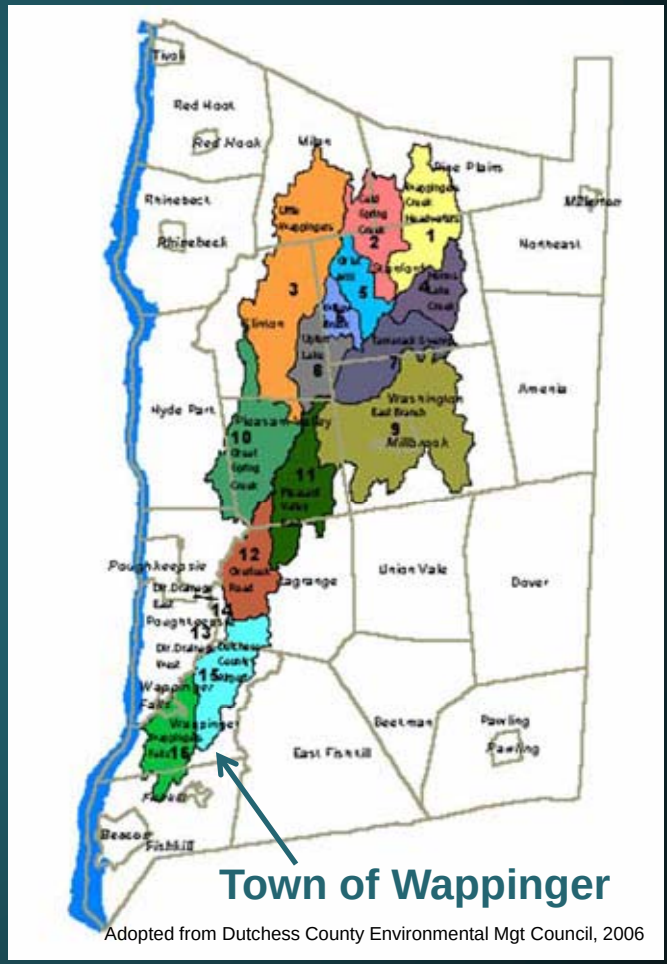
- Local development codes updated to encourage innovative stormwater management
- City stormwater regulations require infiltration of 91 % of runoff onsite
- Approach promoted through outreach and assistance to local development community, homeowners, and businesses
- Pervious concrete is used in construction of streets, sidewalks, bike lanes, and trails

Case Study: Olympia, Washington

- Green Cove Creek drainage basin – designated sensitive
  - Adopted low impact development regulations
  - Directed development away from critical areas
- Examples of code revisions
  - Increase allowable residential densities
  - Limit maximum impervious surface coverage per lot
  - Reduces lot widths and setbacks
  - Reduces widths of local access and collector streets
  - Increases minimum tree density
  - Pervious pavement required in parking lots

Case Study: Wappinger, New York

- MS4 in rapidly urbanizing Dutchess County
- Wappinger Creek and Wappinger Lake on PWL
- Intermunicipal Council for watershed management
- Undertook comprehensive analysis of local codes in 2004-2005
  - Grant from NYSDEC Hudson River Estuary Program through SWCD
  - Town worked with NYSDEC, Center for Watershed Protection and EMC
  - Held roundtable discussions and compiled recommendations



Adopted from Dutchess County Environmental Mgt Council, 2006

Case Study: Wappinger, New York

- Objectives:
  - Reduce overall site impervious cover
  - Preserve/enhance existing natural areas
  - Integrate stormwater management
  - Retain marketability of developments

- Recommendations:
  - Ensure protection of wetland or watercourse buffers and vegetation during and after construction
  - Reduce minimum street widths for new subdivisions
  - Encourage use of alternative street and driveway layouts
  - Allow pedestrian paths as alternative to sidewalks

Case Study: Wappinger, New York

- Recommendations (ctd.):
  - Remove the requirement for cul-de-sacs to be completely paved with no center islands
  - Allow vegetated swales as alternative to closed drainage where density, topography, and soils permit
  - Promote shared parking arrangements where feasible
  - Use pervious pavement for overflow parking areas
  - Remove requirement that landscaped islands be raised
  - Allow conservation/open space subdivisions “by right”
  - Require direction of roof runoff to rain gardens where feasible in new developments

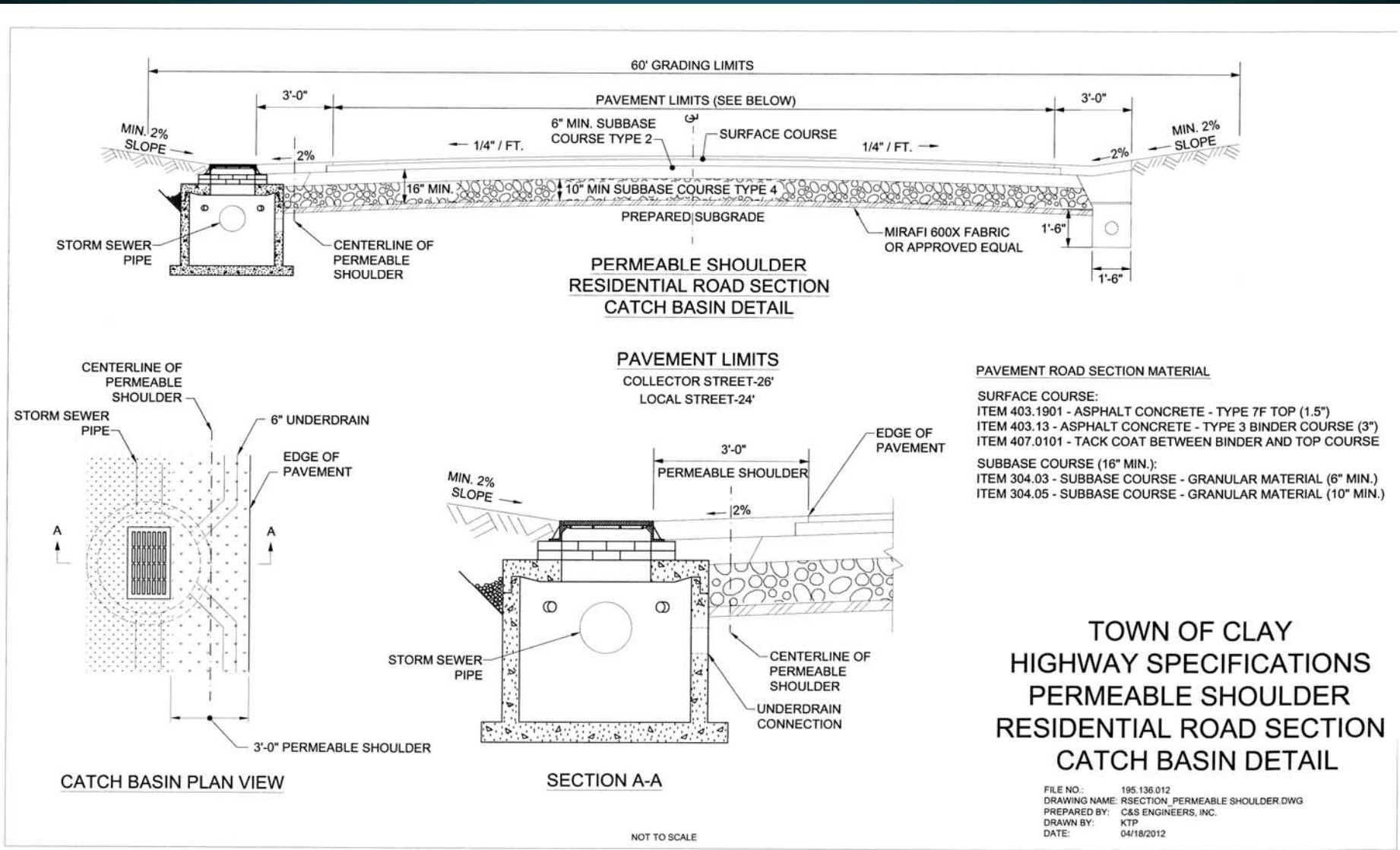
Case Studies: Local Examples

- Onondaga County (Save the Rain Suburban Green Infrastructure Program)
- Town of Manlius
- Town of DeWitt
- Town of Clay

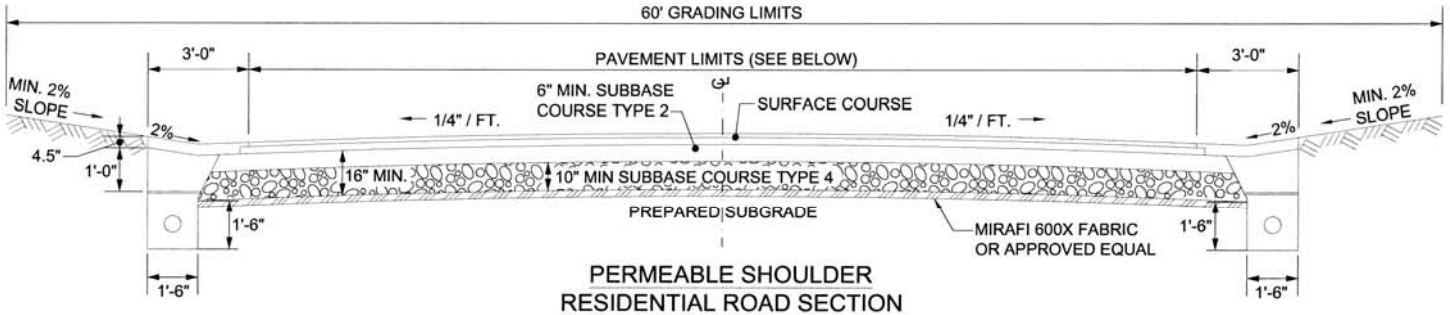

Source: Onondaga County


Source: Town of DeWitt

Case Study: Clay, NY



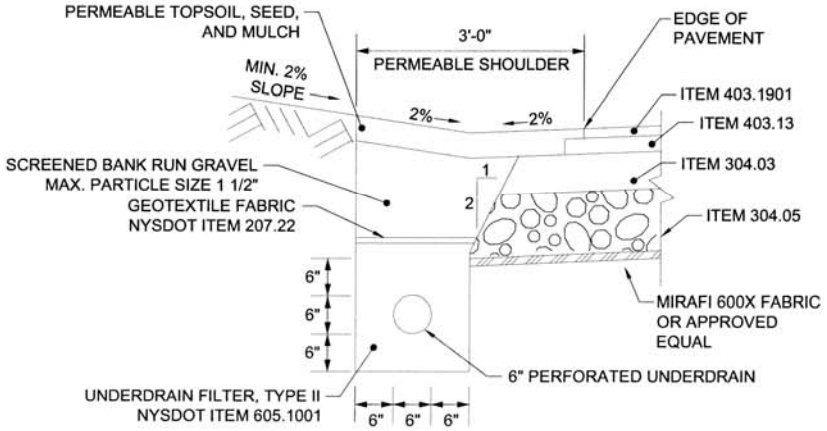
Case Study: Clay, NY



PERMEABLE SHOULDER
RESIDENTIAL ROAD SECTION

PAVEMENT LIMITS

COLLECTOR STREET-26'
LOCAL STREET-24'



EDGE OF ROAD DETAIL

PAVEMENT ROAD SECTION MATERIAL

SURFACE COURSE:
ITEM 403.1901 - ASPHALT CONCRETE - TYPE 7F TOP (1.5")
ITEM 403.13 - ASPHALT CONCRETE - TYPE 3 BINDER COURSE (3")
ITEM 407.0101 - TACK COAT BETWEEN BINDER AND TOP COURSE

SUBBASE COURSE (16" MIN.):
ITEM 304.03 - SUBBASE COURSE - GRANULAR MATERIAL (6" MIN.)
ITEM 304.05 - SUBBASE COURSE - GRANULAR MATERIAL (10" MIN.)

NOT TO SCALE

TOWN OF CLAY
HIGHWAY SPECIFICATIONS
PERMEABLE SHOULDER
RESIDENTIAL ROAD SECTION

FILE NO.: 195.136.012
DRAWING NAME: RSECTION_PERMEABLE SHOULDER.DWG
PREPARED BY: C&S ENGINEERS, INC.
DRAWN BY: KTP
DATE: 04/18/2012

Discussion Panel

- **Madison Quinn**, Onondaga County Save the Rain Program
- **David Tessier**, Director of Planning & Development, Town of Manlius
- **James Conlon**, Director of Planning & Zoning, Town of DeWitt
- **Ronald DeTota, P.E.**, C&S Companies representing Town of Clay

Questions?

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