WATERFRONT ACCESS NORTH REDEVELOPMENT CASE STUDY BURLINGTON VT WATERFRONT

Engineering Ventures
Paul Boisvert, P.E. - Civil Engineer

WAN Project Done With
Resource Systems Group (Prime)
And SE Group (Landscape Architects)

Environmental Work Done by the Johnson Company

Also Includes Moran Project
Freeman French Freeman (Moran Prime)
And SE Group (Landscape Architects)

Environmental Work Done by Waite Environmental

Project Area 2013 (Pre-Construction)

- Flat Site (1% typical)
- Elevation constrained to West, South, and East
- Class 3 wetland to North
- Groundwater 3'-5' below grade, based on monitoring, seasonally variable
- PAH, Arsenic, some petroleum contamination
- Silty sands, fill soils

A Little Bit of Waterfront History


ARCHEOLOGY STUDY AREAS


1869 INSURANCE MAP


1868 RAIL CUT AND TUNNEL


1870 PHOTO, TOWARD ROCKPOINT


APPROXIMATELY 1882

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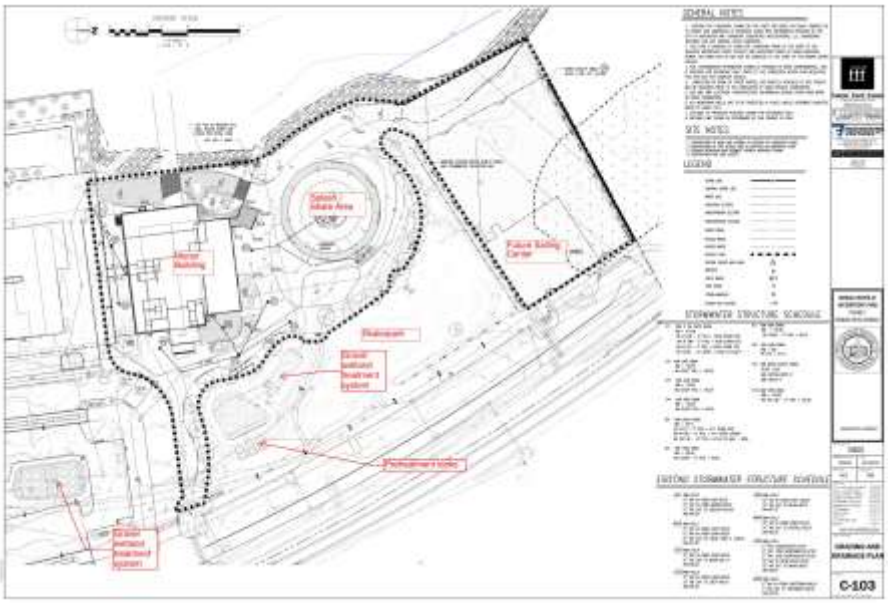
Moran Project Late 2011

- Project team led by Freeman French Freeman Architects
- Concurrent and interrelated to WAN project



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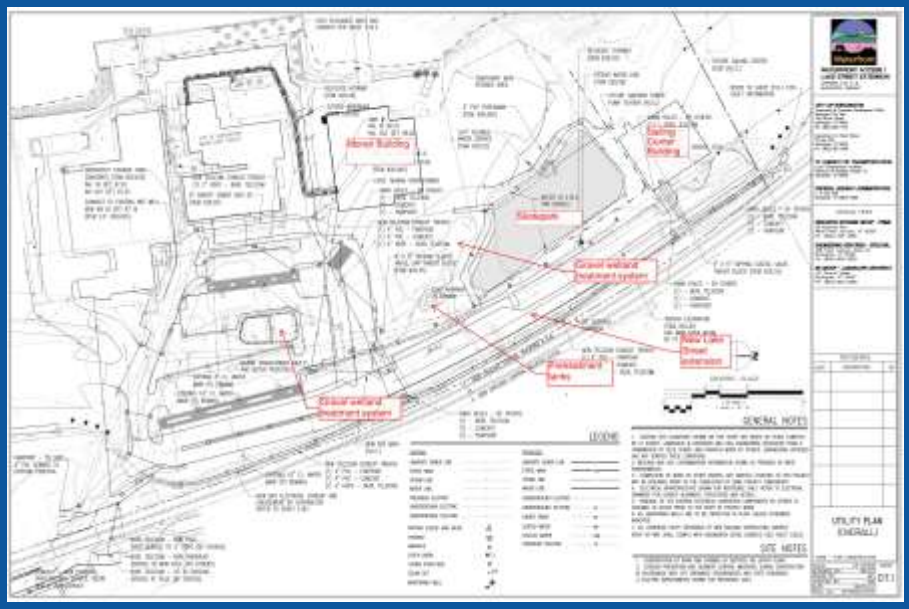
Waterfront Access North (WAN) Project, Late 2011

- Project team led by Resource Systems Group (RSG)
- Concurrent and interrelated to Moran project
- Electrical undergrounding dependent on VELCO gorge project
- Elements of Moran project brought into WAN



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Stormwater Permit Thresholds

- Permit requirements triggered by:
  - Creation of 2.09 AC of new impervious surface (1 AC threshold)
  - Redevelopment of 1.40 AC of impervious surface (1 AC threshold)
- Removal of 0.86 AC of existing impervious
- Net increase: 1.23 AC
- Using final site configuration for following slides (varies from originally permitted plan)

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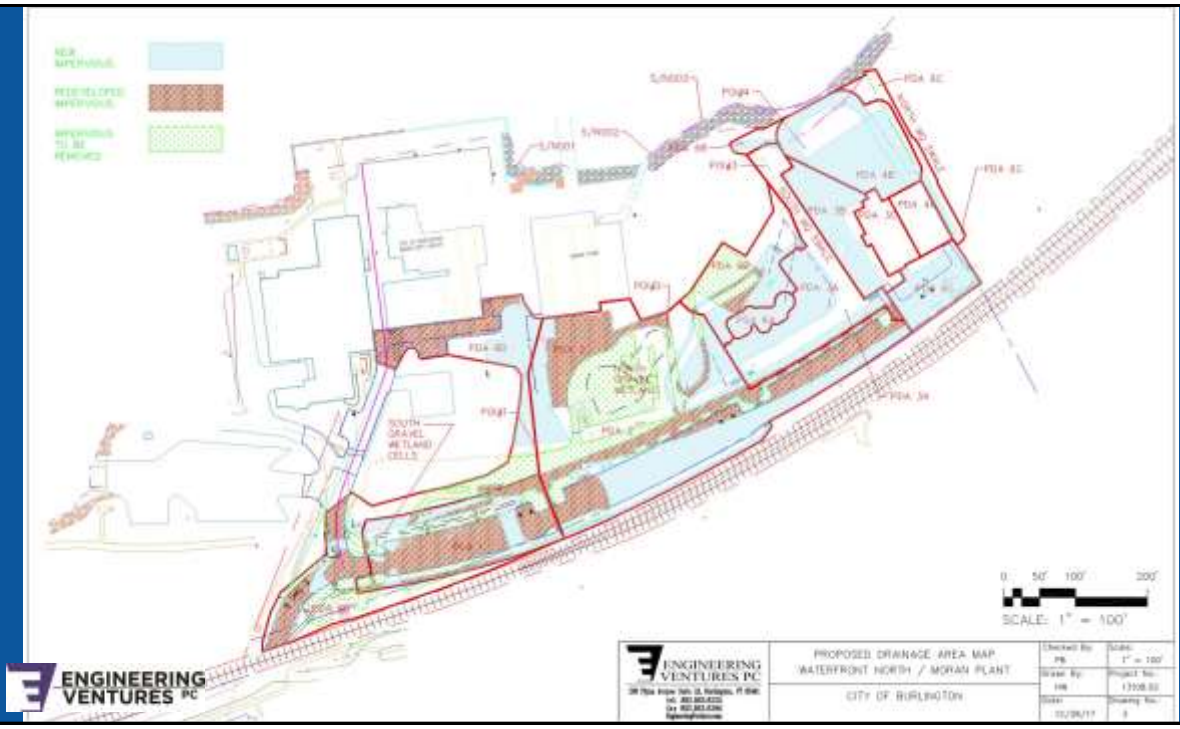

2002 VT Stormwater Manual Requirements

Table 1.1 Required Stormwater Treatment Standards and Sizing Criteria

Criteria	Sizing Requirement
Water Quality (WQ$_v$)	90% Rule: $WQ_v = [(P)(R_v)(A)] / 12$ expressed in acre-feet when A has units of acres. where: P = 0.9 inches R_v = Runoff Coefficient = [0.05+0.009(I)] I = Impervious Cover (whole number percent) A = Site (area in acres) Note: Minimum WQ_v = 0.2 inches (0.0167 ac-ft.)
Recharge (Re_v)	Hydrologic Soil Group[1] Recharge Requirement A 0.40 inches x impervious area B 0.25 inches x impervious area C 0.10 inches x impervious area D waived
Channel Protection (CP_v)	Default Criterion: CP_v = 12 hours extended detention of post-developed 1-year, 24-hour rainfall event in coldwater fish habitats (24 hr. detention in warmwater fish habitats).
Overbank Flood (Q_{p10})	Control the post-developed[2] peak discharge from the 10-year storm to 10-year pre-development[3] rates.
Extreme Storm (Q_{p100})	Control the peak discharge from the 100-year storm to 100-year pre-development rates.

- Redevelopment requirements met by removal of greater than 20% (0.86 AC removed > 20% of 1.40 AC)
- Treatment requirements for new impervious areas exceeded by use of:
  - Two gravel wetland systems
  - Two stormwater treatment swales
- Recharge not required for fill and/or contaminated soils but could be met by treatment swales
- Not required due to size of receiving water
- Not required due to size of receiving water

Stormwater Approach

- Site balancing approach to focus treatment of vehicle areas rather than new pedestrian area (individual permit required)
- Gravel wetland treatment for most road areas
  - Exceeded 80% sediment removal and 40% phosphorous removal targets
  - Currently approved at "Tier 2"
  - Requires only 3" to 6" of drop between inlet and outlet
  - Lined due to shallow groundwater
- Sheet flow and treatment swales to treat skatepark and sailing center runoff
  - Avoids drainage grates in and around skatepark
  - Reduces elevation loss in tanks and catch basins
  - Met 2002 treatment standards

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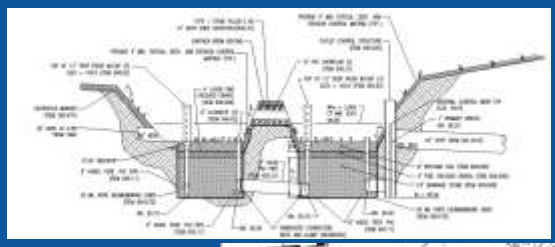
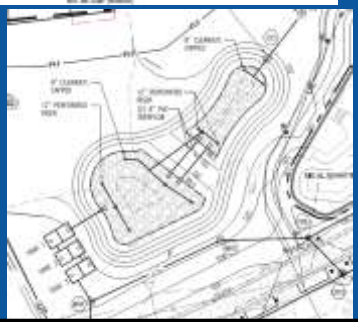
North Gravel Wetland





Features:

- Two cells for sequential treatment
- Treatment area surface 3,460sf
- Surface area > ¼% of contributing drainage area, but sized to match UNH test site area ratio
- Approved for 2.48 AC area with 1.66 AC impervious
- 10% WQv in pretreatment
- 24 hour detention of WQv based on center of mass or minimum 1" orifice
- Horizontal flow

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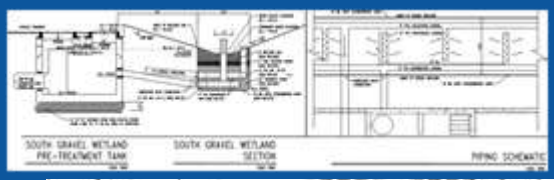
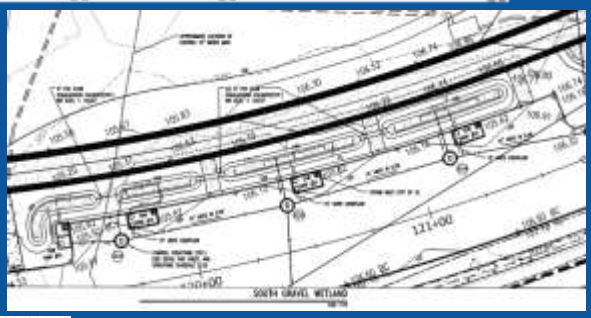
South Gravel Wetland





Features:

- Horizontal flow in long direction
- Surface area > ¼% of contributing drainage area, but sized to match UNH test site area ratio
- Approved for AC area with AC impervious
- 10% WQv in pretreatment
- 24 hour detention of WQv based on center of mass or minimum 1” orifice

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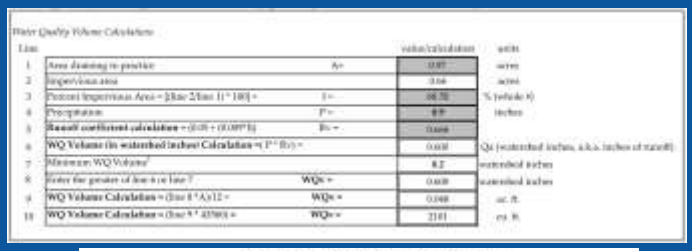
South Water Quality Swale

- Flow-based practices, designed for 10 minute minimum residence time when modeled with a modified NRCS curve number



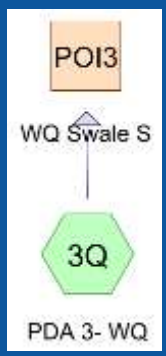
Summary for Reach POI3: WQ Swale S

Inflow Area = 0.965 ac, 0.00% Impervious, Inflow Depth = 0.61" for WQ event
Inflow = 0.98 cfs @ 11.95 hrs, Volume= 0.049 af
Outflow = 0.80 cfs @ 12.06 hrs, Volume= 0.049 af, Atten= 38%, Lag= 4.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 0.44 fps, Min. Travel Time= 14.4 min
Avg. Velocity = 0.09 fps, Avg. Travel Time= 67.3 min

Peak Storage= 522 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 4.75 cfs

3.00' x 1.00' deep channel, n= 0.140
Side Slope Z-value= 3.0 '/' Top Width= 9.00'
Length= 380.0' Slope= 0.0100 '/'
Inlet Invert= 106.00', Outlet Invert= 102.20'



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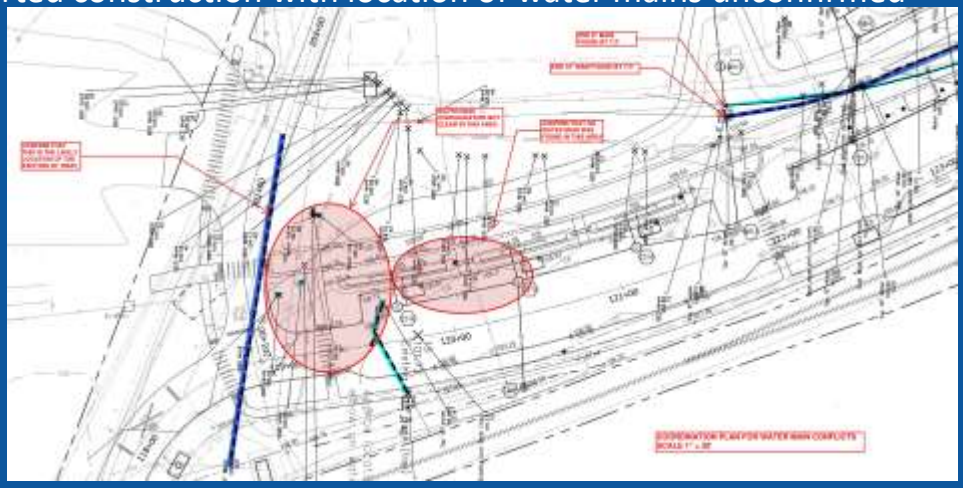
Some Challenges

- Started construction with location of water mains unconfirmed



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Parties Involved

- City of Burlington: CEDO, Public Works, Parks, Planning and Zoning, Burlington Electric, Burlington Telecom, Mayor's office
- State of Vermont: VTRANS, Agency of Natural Resources, Public Service Board (VELCO work)
- Federal: Army Corps, Federal Highway
- Vermont Railways
- Comcast, Fairpoint, VELCO
- Consultants: Resource Systems Group, Freeman French Freeman, SE Group, Johnson Company, Waite Environmental, Grindline, Kirick Eng., LN Consulting, Knight Eng., Vermont Survey, Lamoreaux Dickinson, Civil Engineering Associates, Latitudes Surveying, Geodesign, VHB, UVM CAP, Stantec… and others
- Contractors: SD Ireland, Artisan, Engineers Construction
- 43 People listed on Meeting Minutes CC list during construction
- More at the ribbon cutting

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VELCO Gorge Project

- Public Service Board approval needed for VELCO Gorge project – needed to allow undergrounding
- Potential schedule killer

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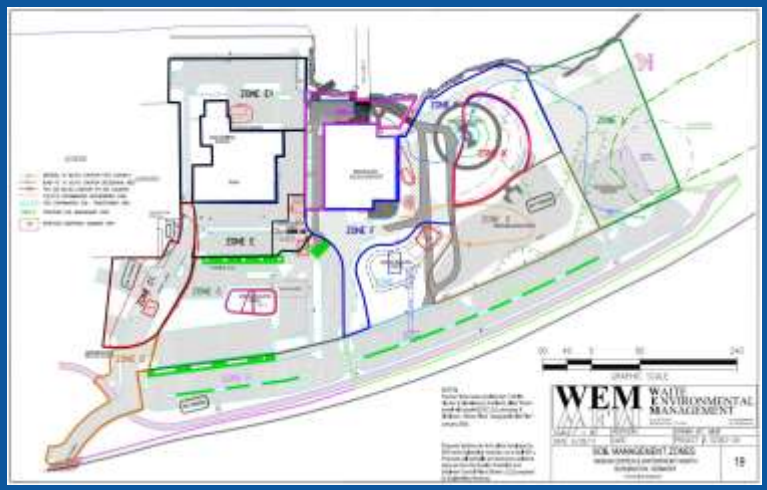
Soil Management



- CAP divided site into soil management zones
- Soil cut & fill estimates were generated for trenching and overall
- Bid plans anticipated 8,000 CY of waste soil
- City snow storage area was tested and used for excess cut
- Looked for ways to encourage soil reuse within the contract
- Included special provisions (specifications) specific to soils:
  - Poly-encapsulation
  - Stockpile management

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Soil Management

- City snow storage area was tested and used for excess cut
- CAP required indicator fabric and 6" of "clean" material or hardscape over full project area, including Flying A site (to right)
- Topsoil depth increased to 6" to satisfy CAP isolation requirements

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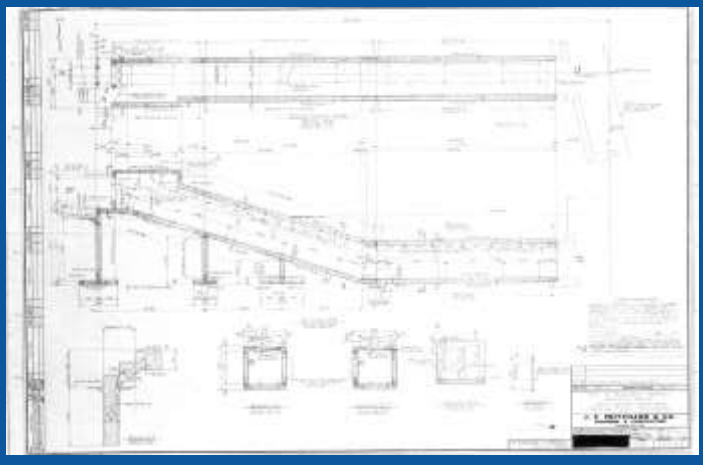
Coal Tunnel



- Partially demolished, then filled with flowable fill
- BUT only after photo documenting since this is a historic feature
- Contractor required to provide a 4 hour window to archeology consultant to document after removing water

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Dewatering

a) Dewatering: Water removed from excavations shall be handled in one of the following ways, depending on location and field evaluation by the Environmental Project Manager (EPM):
   i. Areas of known contamination: Pumped through a 25 micron bag filter, into a fixed axle 21,000 gallon frac tank. Tank to be parked in the fenced yard east of the Moran Plant.
   ii. Presumed contaminated: Pumped through a 25 micron bag filter, into a fixed axle 21,000 gallon frac tank. Tank to be parked in the fenced yard east of the Moran Plant.
   iii. Presumed clean: Pumped through a 25 micron bag filter into one of three infiltration areas noted on the plans.
b) Frac tanks to be pumped to the Municipal wastewater system following 24 hour settling period

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Completed Gravel Wetlands – Following Rain, May of 2016

North Gravel Wetland

South Gravel Wetland

Finished Project from Google Earth

Well, not quite finished
- Marina construction underway in photo
- Moran project still under design

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Some Lessons Learned About Brownfield Redevelopment

- These projects take time: started in 2008, WAN finished 2015-2016
- Account for soil testing delays
- Dewatering can be complicated
- Excavation will find the unexpected: fuel lines, old Asbestos Concrete catch basins, etc.
- Need good contractors
- Each one is an opportunity to replace an underutilized property with something better

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