Establishment of Wetlands for Permit Mitigation: The Process and Lessons Learned

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MS Power Point™ created by Dawn Matzke

Uh-Oh!

Wetland creation is possible….look around you.

<u>RULES</u> for Wetland Establishment:

(For all you '*NCIS*' fans out there…….)

<u>RULE I. Mitigation Goals and Objectives</u>

- Must be realistic *and* obtainable. You *will be* held to these.
- Consult *early* with the regulatory agencies.
- Clearly define before starting the design.

<u>RULE II. "Water, water everywhere…" - maybe</u>

- Be *conservative* everywhere with the design.
- Gather as much water as possible and release the "extra."
- There is an exception… vernal pool establishment.

Wetland Establishment: The Process

Wetland establishment (*i.e.*, creation) can be understood in four parts:

I. Site Selection

II. Site Evaluation and Design

III. Planting Considerations

IV. Construction Monitoring

I. Site Selection

Primary Considerations

1. **Sufficient upland area for establishment? On-site or off-site?**
2. **Must go off-site . Where is there available upland?**
3. **Always allow for area loss from planned grades/slopes.**
4. **Going off-site, public or private land? Pros & Cons.**
5. **Prefer a site with a large contributing drainage area (*i.e.*, watershed).**

II. Site Evaluation and Design

1. Wetland Establishment is directed by the Water Budget .
2. Maximize “edge” in the design while achieving the necessary area.
3. Don’t neglect the “vertical dimension” with your design.
4. Plan for the disposal of excess soils. On-site or off-site?
5. Use recognized landscape design and site construction practices. When departing from, ALWAYS provide a clear and logical rationale.

$$\Delta V/\Delta t = PD + S_i + G_i - PET - S_o - G_o$$

$\Delta V/\Delta t$ = change of water storage in the wetland per unit time, t

PD = direct precipitation (*e.g.*, rain, snow, *etc.*) falling into the wetland

S_i = surface water inflows, primarily drainage area runoff (sheet or concentrated)**

G_i = groundwater inflows (usually via infiltration from water table)

PET = potential evapotranspiration

S_o= surface water outflows (usually via a designed outlet)

G_o = groundwater outflows (usually as infiltration through the wetland basin)

<u>NOTE</u>: For practicality, "volume" is rendered as inches of water above the lowest planned elevation for the wetland establishment area and relative to the elevation of the designed outlet. All components are likewise expressed in inches of water.

** S_i may include intercepted high flows from watercourses.

PD – DIRECT PRECIPITATION (INFLOW)

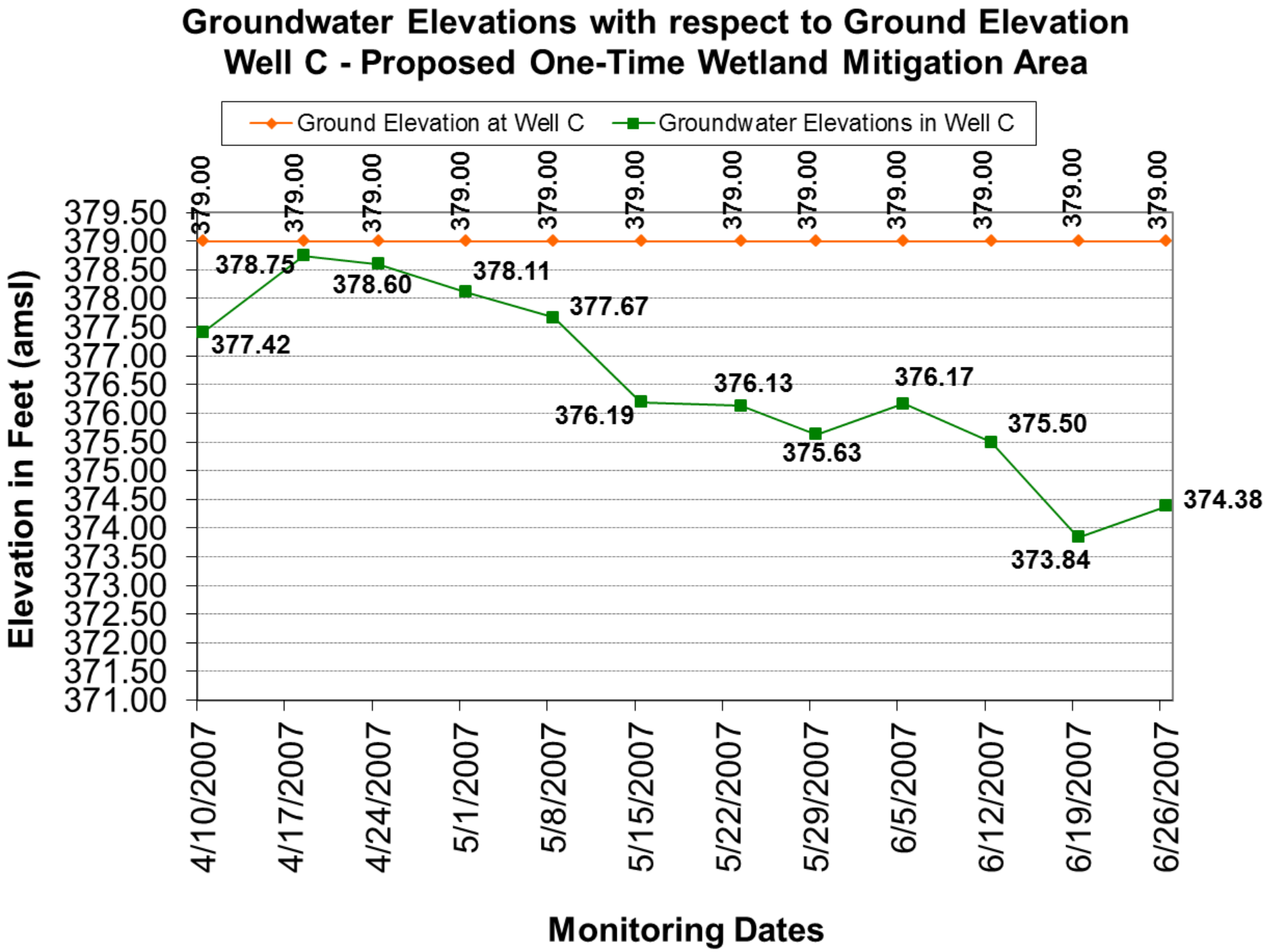
- All forms of precipitation (rain, snow, *etc.*) falling <u>directly</u> <u>onto</u> the wetland establishment area (WEA).
- Obtain precipitation and climate data from reputable sources (*e.g.,* certified weather stations) closest to the WEA.
- Concerning snow – conservative estimate is 10 inches = 1 inch liquid water.
- Use data from average, dry, and wet years. Average precipitation can be found in county soil surveys.
- CLOSELY examine weather records to avoid using data from a hurricane event, blizzard event, or any other deviations from average climate.

S_i – Surface Water Inflow

- Represents inputs via various forms of run-off.
- Produced by precipitation falling onto the drainage area contributing to the WEA.
- S_i is a mathematical combination of the run-off generating potential of the drainage area with precipitation events. The run-off generating potential of the drainage area is determined by a mathematical combination of soil properties with land uses and cover types.
- Unlike PD, S_i is not a 1:1 gain. Run-off is only produced from precipitation events of sufficient duration and intensity.
- As a CONSERVATIVE approach, only consider precipitation events of 1.00 inch or more. Measurable run-off is often only produced by >0.50 inch.
- Again, use data from average, dry, and wet years and avoid data from extreme weather events.

G_i – Groundwater Inflow

- Represents input via infiltration through the soil comprising the WEA basin.
- Produced by a portion of precipitation contributing to aquifers and shallow water tables.
- G_i is the most difficult, and can be the most expensive, component to quantify.
- The movement of water through the soil column is directly related to soil composition and *in-situ* properties.
- Soil surveys frequently provide transmission rates for water through the various soil types, or these rates can be calculated. Use caution! Many parameters.
- The conservative approach is to plan for minimal (if any) contribution of G_i to the WEA.
- However, WEAs can use groundwater from reachable shallow water tables that fluctuate seasonally. Test Pits (TPs) are used to determine this possibility.
- TPs enable examination of the soil column (*i.e.,* profile), investigation for groundwater influence, and the means to install monitoring wells.
- Monitoring wells (MWs) are used to determine the elevation of shallow groundwater within the soil column.


Groundwater Elevations with respect to Ground Elevation
Well C - Proposed One-Time Wetland Mitigation Area
Ground Elevation at Well C
Groundwater Elevations in Well C
Elevation in Feet (amsl)
379.50
379.00
378.50
378.00
377.50
377.00
376.50
376.00
375.50
375.00
374.50
374.00
373.50
373.00
372.50
372.00
371.50
371.00
379.00
378.75
378.60
378.11
377.67
377.42
376.19
376.13
375.63
376.17
375.50
373.84
374.38
4/10/2007
4/17/2007
4/24/2007
5/1/2007
5/8/2007
5/15/2007
5/22/2007
5/29/2007
6/5/2007
6/12/2007
6/19/2007
6/26/2007
Monitoring Dates

G_o – Groundwater Outflow

- Represents water lost through the basin of the WEA by infiltration into the underlying soil column.
- Like G_i, G_o is difficult, and expensive, to quantify. Conservatively, G_o and G_i should be assumed as equal, or $G_o > G_i$.
- As a water loss, G_o should be minimized as much as possible.
- If the WEA must located in areas with high infiltration rates, the native soils can be amended or modified to reduce these rates. Can be expensive.
- Also, if the WEA must be located over areas with shallow bedrock that is fractured or composed of shale, the basin can be sealed using a geo-synthetic clay liner (GCL). This is expensive!
- AGAIN – be conservative. Fall back on the 'KISS' principle, "Keep it simple, stupid." In the long run, finding a better suited site and planning $G_o > G_i$ is more prudent and cost-effective.

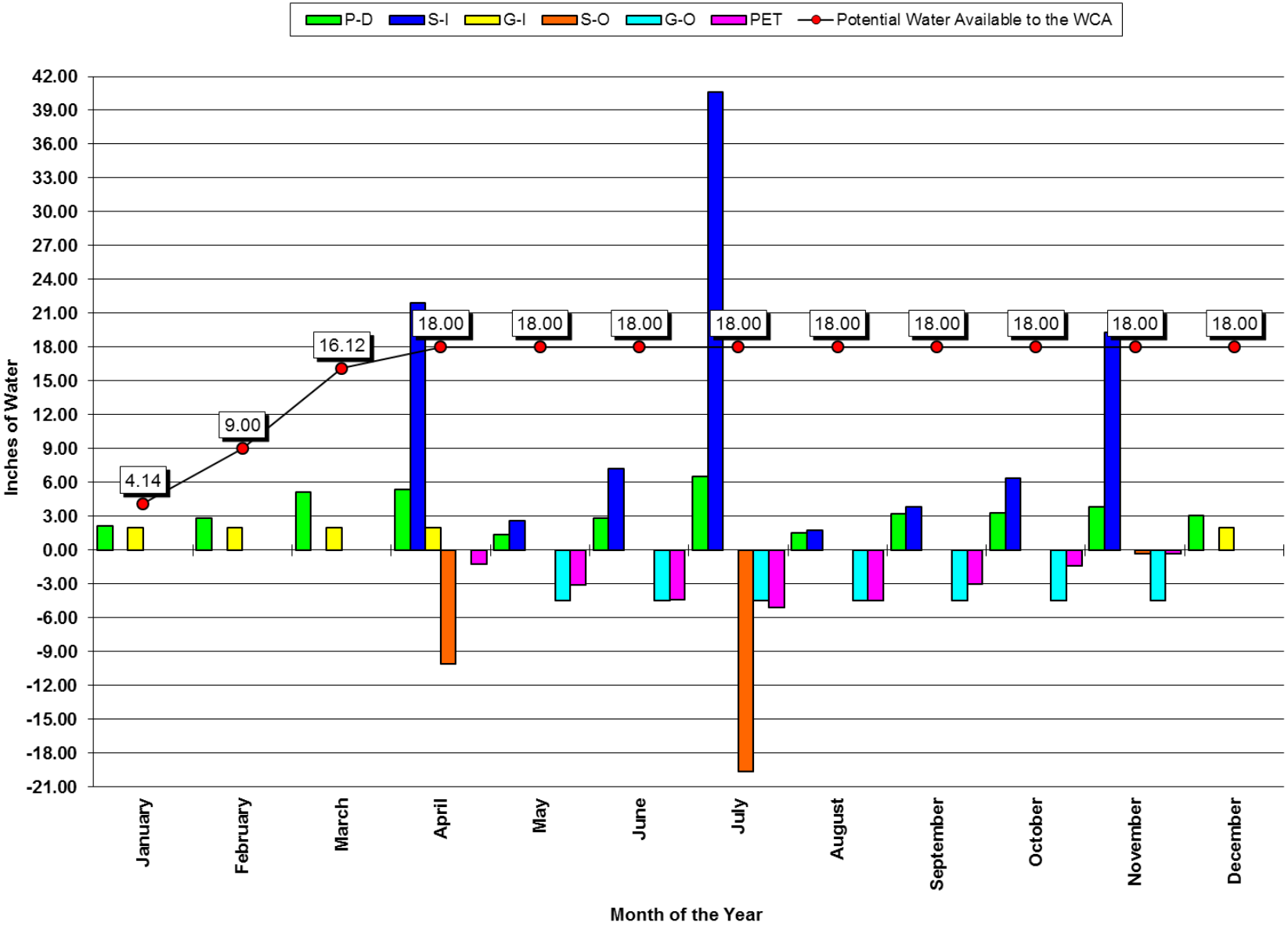
PET – Potential Evapotranspiration

- PET is the water that vaporizes from the surfaces of open water and soil in a wetland (evaporation), together with moisture that passes through vascular plants to the atmosphere (transpiration).
- PET is often determined through a direct calculation that is dependent upon temperatures above freezing and the latitude of the WEA.
- In the northeastern U.S., water loss from PET ranges from 18 to 24 inches in years with growing seasons of average precipitation and temperatures.
- The temperature component of PET tends to affect its expression as a lagging and shifted bell curve over the length of the growing season (that is, starts slows, picks up steam, and then ceases abruptly).

S_o – Surface Water Outflow

- S_o represents water lost via controlled release through a designed surface outlet located along the perimeter of the WEA.
- Represents the component of the water budget most readily controlled and manipulated.
- The amount and rate of surface water outflow is controlled by the elevation and configuration of the outlet structure.
- The form and design of the outlet should be as simple as possible and require little to no long-term maintenance.
- The elevation of the outlet is directly related to the planned hydro-period of the WEA and linked to the water depths designed for planting and habitat zones. The elevation of the outlet should be easily adjustable.

Water Budget
WCA - One-Time Project
Year 1 Projection - Average Precipitation Year
Maximum Inundation Depth Allowed by Outlet = 18 inches

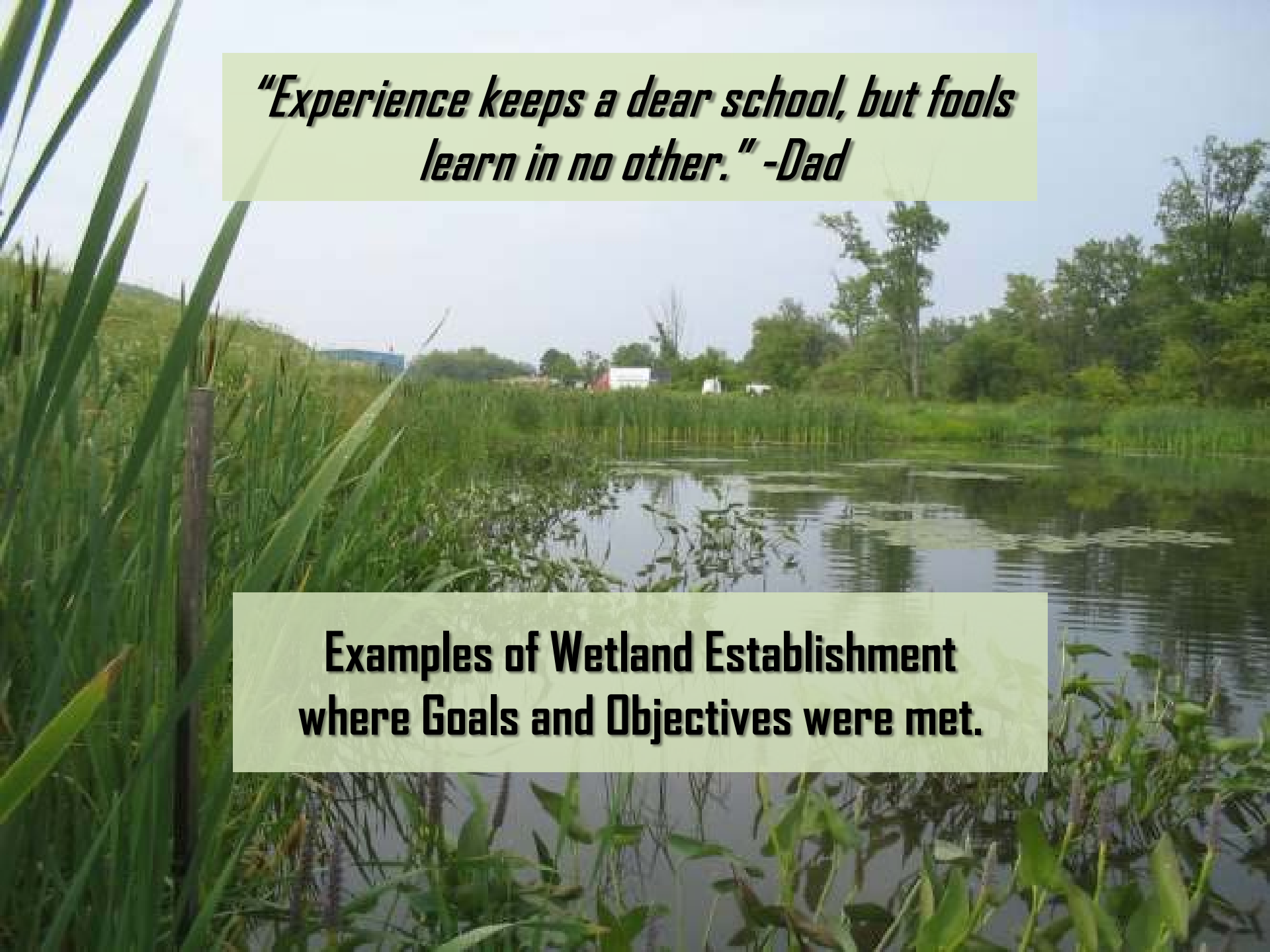


III. Planting Considerations

1. Don't waste money! Keep the amount of plantings modest and the variation simple. Eventually "Mother Nature" is going to run with the WEA regardless.
2. Make sure the design does not encourage the growth of nuisance or permit prohibited plant species.
3. Be pragmatic. Use plantings to focus on ways to minimize sloughing and erosion and ways to control the establishment and spread of nuisance species.
4. Prepare in advance for potential problems from nuisance or permit prohibited plant species. Find licensed aquatic herbicide applicators and vendors of bio-controls (*e.g.*, beetles).

IV. Construction Monitoring

1. Monitor construction regularly! Do not skimp on this step. The best wetland establishment plan is only as good as its correct execution and is easily undone by poor implementation.
2. A pre-construction meeting is invaluable. There are always questions to be answered. Show up with donuts and coffee.
3. Establish and maintain a good rapport with the construction site crew. Help them assume ownership in the task.
4. Communicate clearly and often with the site crew. Recognize that you and the site crew personnel come from professions with opposite views toward your goal.
5. Treat the site crew personnel with respect. These people are professionals who are usually very capable and good at what they do. They can build almost anything with the correct guidance – remember <u>communicate</u>!



"Experience keeps a dear school, but fools learn in no other." -Dad

Examples of Wetland Establishment where Goals and Objectives were met.

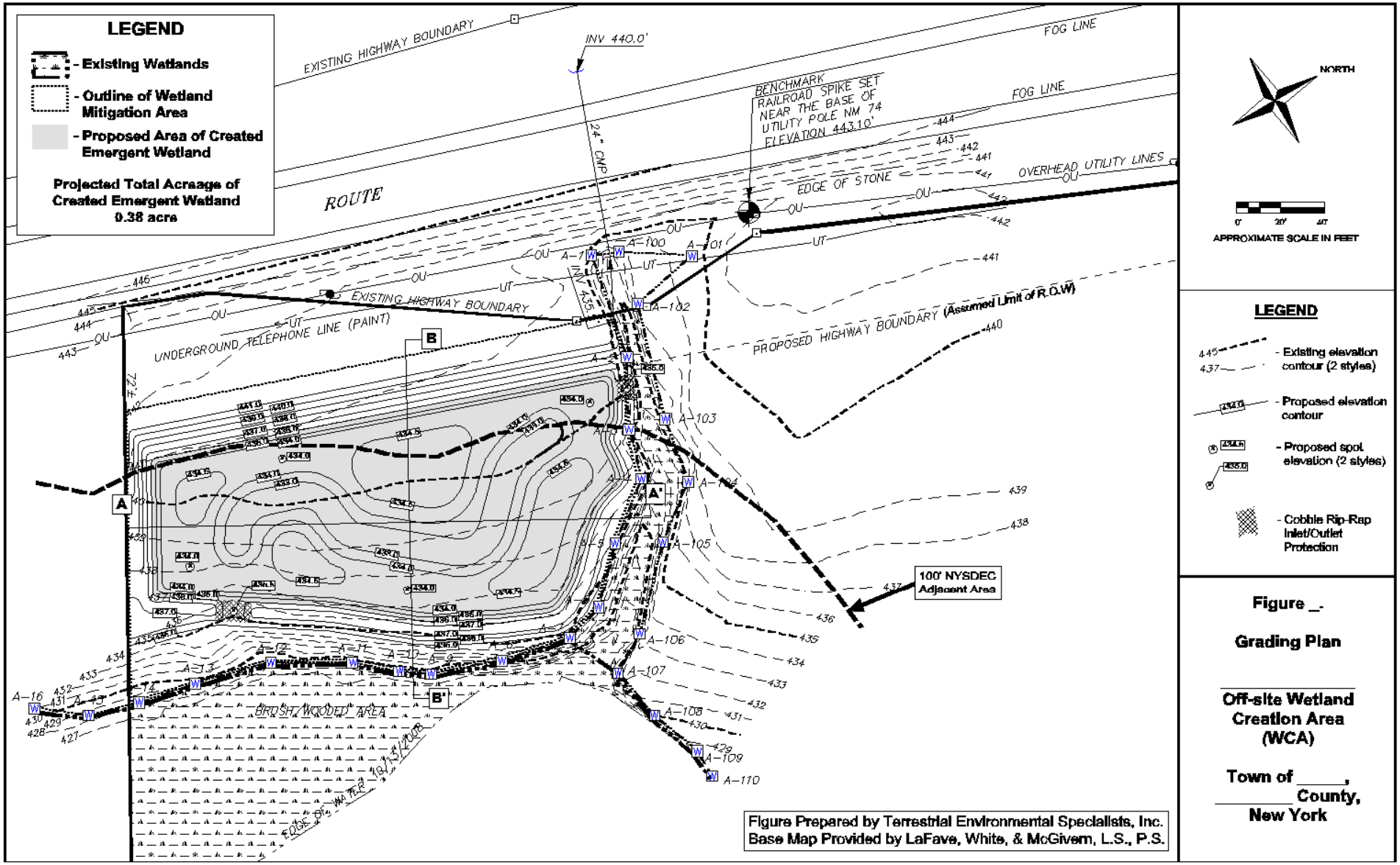


Figure Prepared by Terrestrial Environmental Specialists, Inc.
Base Map Provided by LaFave, White, & McGivern, L.S., P.S.

Figure _.

Grading Plan

Off-site Wetland Creation Area (WCA)

Town of _____, _____ County, New York

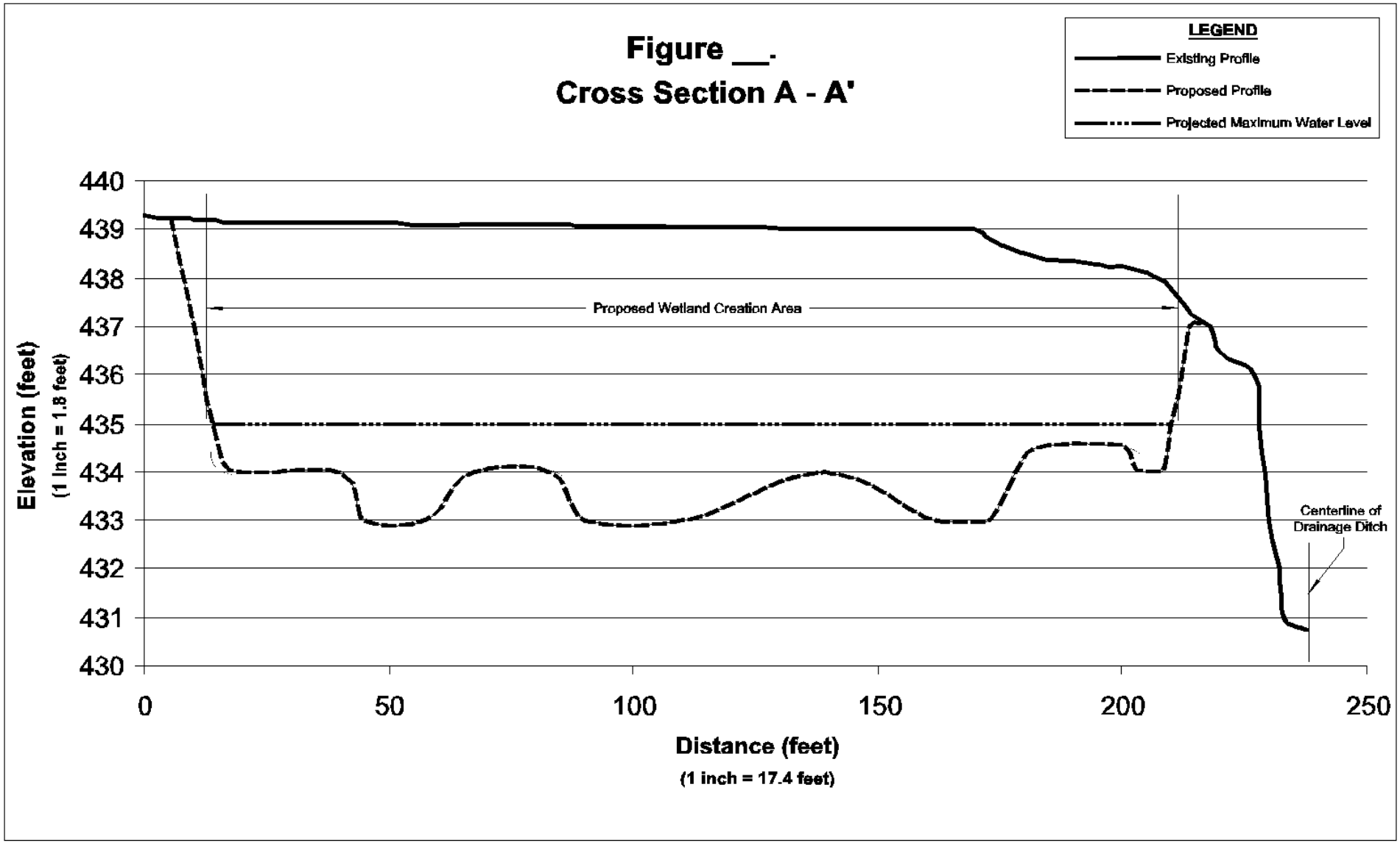
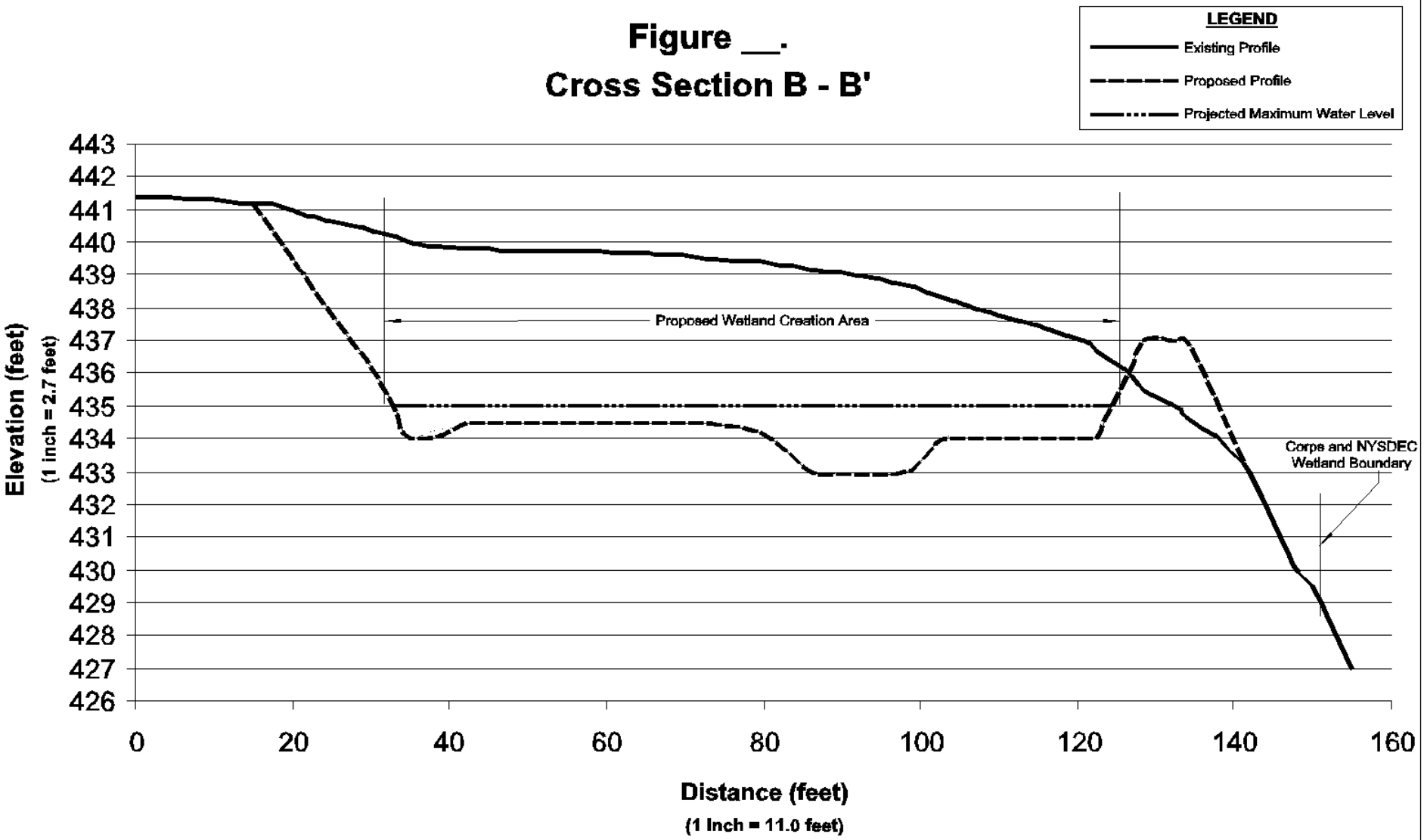
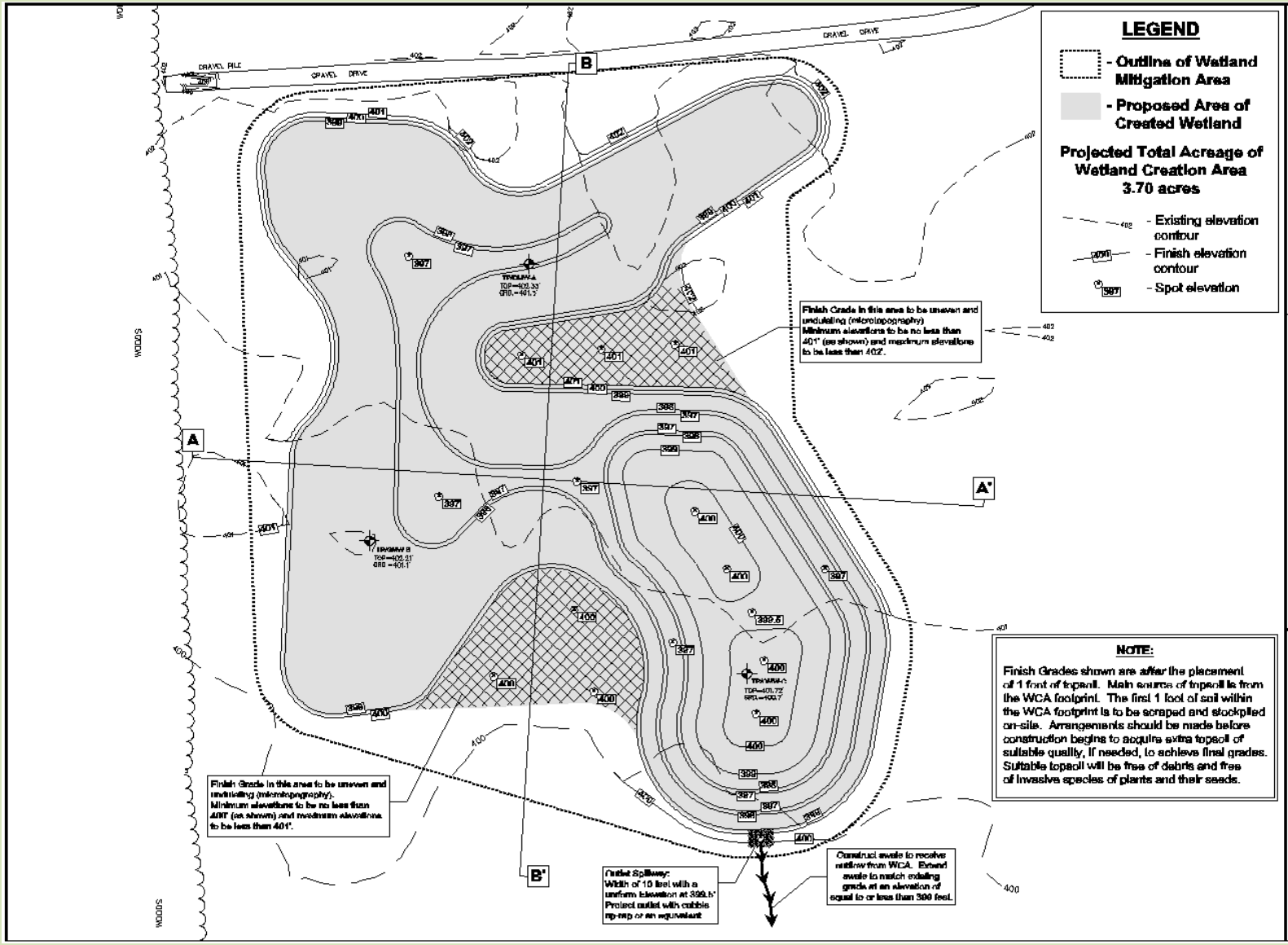


Figure __.
Cross Section A - A'
LEGEND
Existing Profile
Proposed Profile
Projected Maximum Water Level
Proposed Wetland Creation Area
Centerline of Drainage Ditch
Elevation (feet)
(1 inch = 1.8 feet)
440
439
438
437
436
435
434
433
432
431
430
0
50
100
150
200
250
Distance (feet)
(1 inch = 17.4 feet)

Figure __.
Cross Section B - B'





Base Map obtained from CNY Land Surveying

Figure Prepared by Terrestrial Environmental Specialists, Inc.

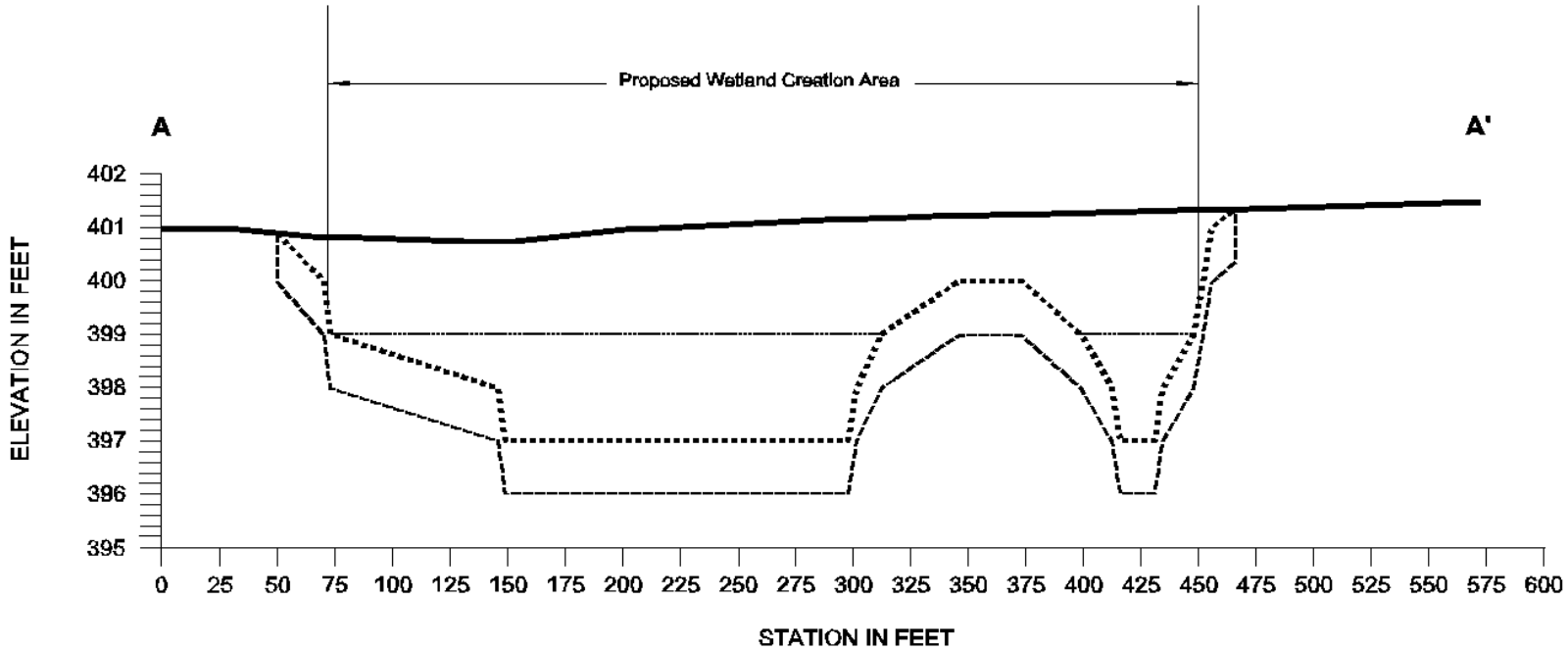
Figure __.

Grading Plan

Wetland Creation Area (WCA)

_____

_____



APPROXIMATE SCALES:

Horizontal (H) 1 Inch = 50.0 feet
Vertical (V) 1 Inch = 2.175 feet

Scale Ratio (H:V) - 23:1

LEGEND

- Existing Grade
- Finish Grade
- Excavation Grade (to allow for 1 foot of topsoil)
- Projected Maximum Water Level

Figure __.

Cross Section A - A'

Wetland Creation Area

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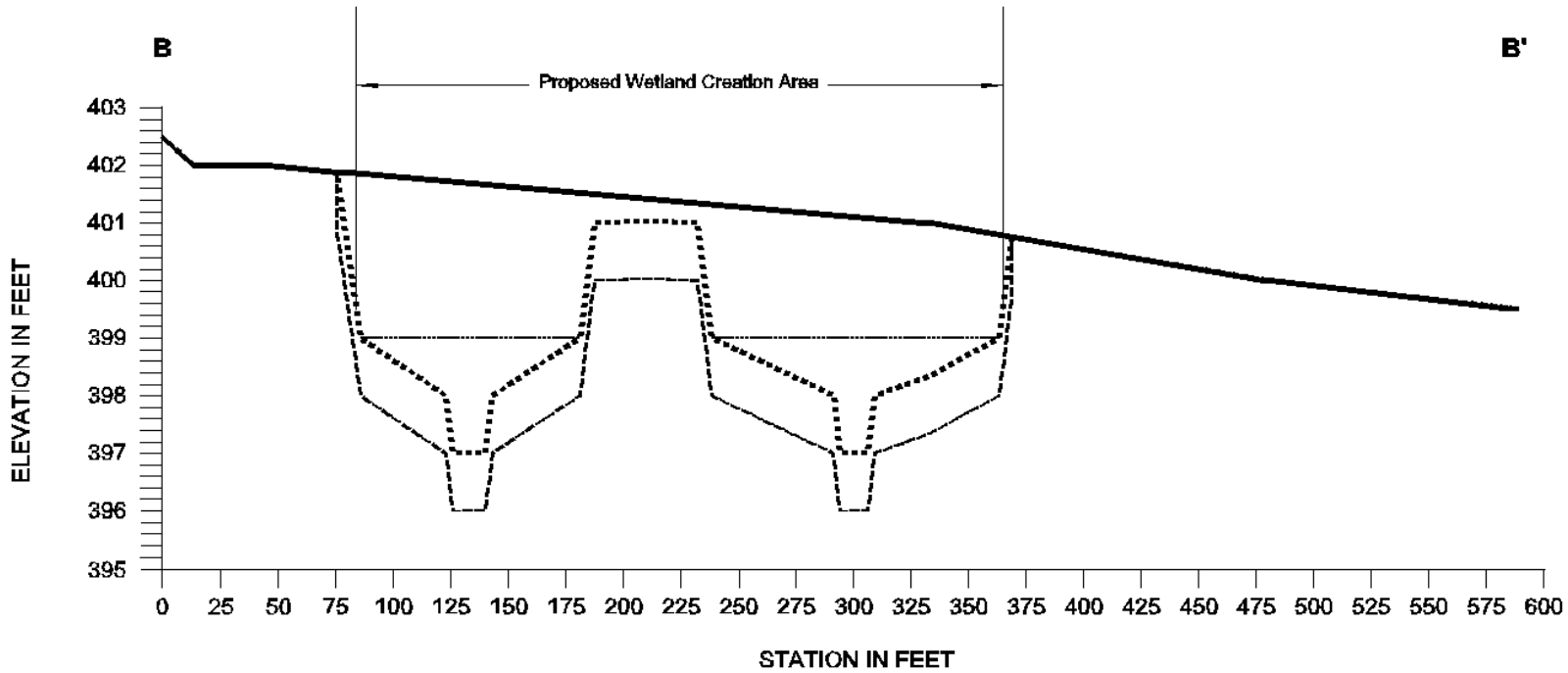

APPROXIMATE SCALES:

Horizontal (H) 1 inch = 50.0 feet
Vertical (V) 1 inch = 2.0 feet

Scale Ratio (H:V) - 25:1

LEGEND

- Existing Grade
- Finish Grade
- Excavation Grade (to allow for 1 foot of topsoil)
- Projected Maximum Water Level

Figure __.

Cross Section B - B'

Wetland Creation Area

Prepared by: Terrestrial Environmental Specialists, Inc.

Upper Canal

Uh-Oh!

Thank You for your time & attention!

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