CAPSTONE EXPERIENCE 2015

EXCAVATED POND

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Agricultural & Biological ENGINEERING

Problem Statement

Figure 1. Pond/Stockpile Aerial View

Mr. and Mrs. Alexander wish to have a pond constructed on a currently unused section of their property just east of Dayton, Indiana. This pond will be used for recreation, wildlife habitat, and for aesthetic purposes and should not attract mosquitoes. Due to topography, the pond has a negligible contributing watershed, so a well must be installed as the pond's water source. Methods to manage water loss will be vital to the pond's sustainability. Disposal of spoil also plays a large role in this design, especially in terms of cost. Previous soil tests conducted by the NRCS show soil profiles and that there are no restrictions for a pond. A complete pond design will also include a computer drafted design, applicable permit applications, and a budget.

Figure 2. Pond Site Ground View

Constraints and Criteria

- Slopes must be stable and not conducive to excessive vegetation growth
- Depths must support fish as well as swimming
- Keep spoil on site
- Maintain an appropriate water level at all times
- Minimal impact to surrounding area
- Aesthetically appealing

AutoCAD Civil 3D Design

Pond

Slopes
- 3:1 except for beach area to cut down on vegetation/weeds
- 7:1 beach area (southwest)

Depths
- 4 ft beach depth
- 10 ft north-most and south-most portion (roughly ¼ of the pond)
- 5 ft average everywhere else

Stockpile

Slopes
- 2:1 slopes everywhere as per construction stockpiling standard

Heights
- Vary from 10 feet on the southern side to 20 feet on the northern side

Volume
- Stockpile = 6200 cu. yds
- Top soil = 1500 cu. yds
- Pond = 8000 cu. yds

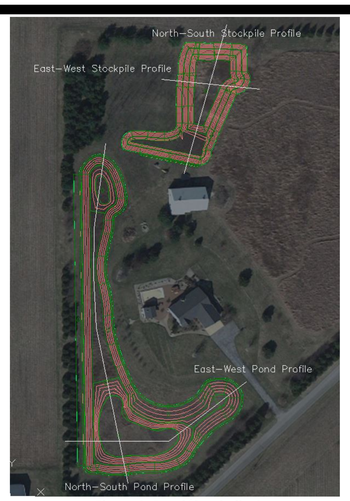
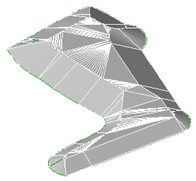
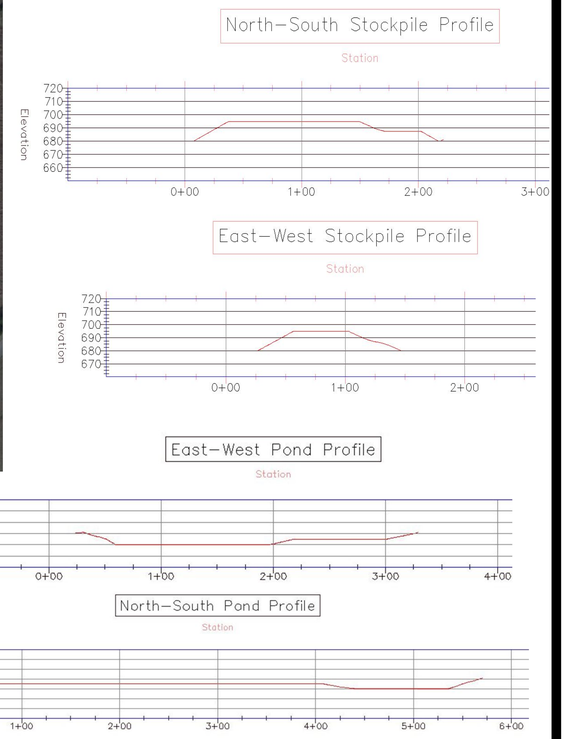


Figure 3. Pond/Stockpile Contours





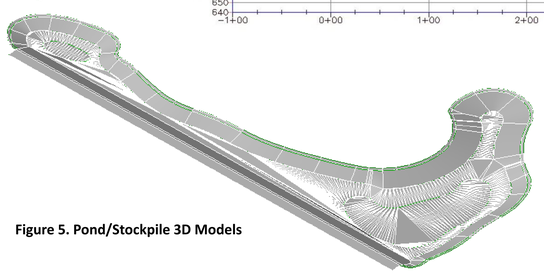


Figure 5. Pond/Stockpile 3D Models

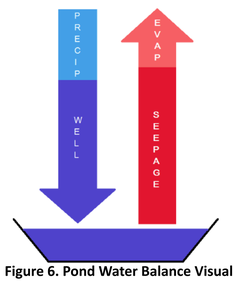


Figure 6. Pond Water Balance Visual

Table 1. Water Inputs and Outputs

Natural Annual Inputs/Outputs	
Gallons	
Seepage	-2,355,000
Evaporation	-841,000
Precipitation	1,162,000

Water Balance

- Over 4 ft of the subsurface soil that will be excavated contains enough clay to use for a compacted layer
- Compacted layer will be 1 ft in depth and will reduce seepage from the pond
- Little to no runoff will go into the pond due to its elevation
- About a 6 ft deficit will have to be replenished each year

Table 2. Monthly Water Replacement

Month	Pump Rate	Water Replaced
	GPM	Gal.
Jan	3.1	138,000
Feb	3.0	122,000
Mar	3.0	133,000
Apr	3.4	145,000
May	3.8	169,000
Jun	4.9	211,000
Jul	5.5	246,000
Aug	5.3	235,000
Sept	5.2	226,000
Oct	4.0	177,000
Nov	2.6	113,000
Dec	2.7	121,000
Total		1,898,000

Well Considerations

- Based on Indiana DNR well database information for nearby wells and NRCS drawdown equations, the new well will cause 14 feet of drawdown but still leave 20 feet of water above the well screen
- Pumping intermittently at high flow will save electric over constant low flow pumping

Societal Impacts

- Potential for increased mosquito population
- Minimal drawdown in groundwater level
- Increased wildlife habitat
- Increased erosion from stockpile if not managed properly

Table 2. Anticipated Costs

Anticipated Costs	
Description	Cost
Excavation and stockpiling($2.50/yd^3)	$25,000*
Well drilling and casing (100 ft.)	$3,000
Well pump(50 gpm) and control panel	$1,000
Diffused Aerator(1 acre)	$1,350
Fish(1000 bluegill, 200 bass, 100 catfish, 1000 minnows)	$775
Shrubs and grass seed	$500
Total	$31,625

* Actual excavation cost should be less due to landowner having access to equipment

Alternative Designs

- Alternative designs for beach area, slopes, depths, and overall pond area/volume
- Different stockpile designs for heights and areas
- Plastic Pond Liner ($0.65/SF, about $35,000)
- Aeration by fountain or waterfall

Sponsor:
Gary and Lynette Alexander

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