

# **GWYNNE CONSERVATION AREA**



## **Gwynne Orienteering Course Report of Survey**

**Survey Prepared by  
Civil Engineering Technology  
Construction Sciences Department  
Columbus State Community College  
Autumn Quarter, 2003**

**Submitted by  
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## Map Design and Compilation

### TASK A:

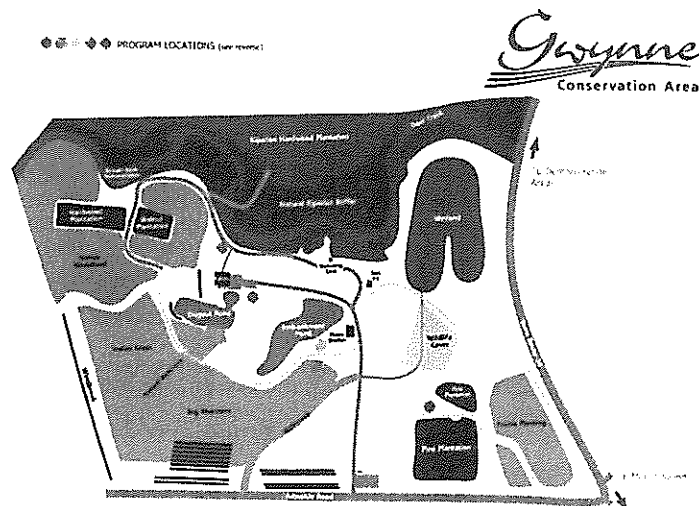
#### Plan and Design a Map of Gwynne Conservation Area

##### Introduction:

Early Summer Quarter 2002 the faculty of Columbus State Community College's Civil Engineering Technology were approached by a consortium of Gwynne Conservation Area and West Jefferson Middle School to assist in establishing an Orienteering Course at the Gwynne Conservation Area - OSU Farm Science Review. The Gwynne Conservation Area is a part of the Molly Caren Agricultural Center near London, Ohio. The establishment of the Orienteering Course was the result of a grant from Toyota to West Jefferson Middle School and the Gwynne Conservation Area. The Orienteering Course is a compass course consisting of a series of concrete monuments set at Station Points throughout the Conservation Area. Educational projects (Activities) involving natural resources, ecology or a myriad of earth science courses can be set at each of the Activity Station Points. The Gwynne Conservation Area personnel and West Jefferson Middle School faculty needed the distances and magnetic azimuths between the Activity Stations for the orienteering portion of the exercises. The Columbus State faculty included Dallas Morlan, P.S. and Robert J. Mergel, P.E., P.S. Mr. Morlan served as the project coordinator with Mr. Mergel serving as a resource person. Bryan Smith of Tobin-McFarland Surveying, Inc. participated as a representative of Central Ohio Chapter, Professional Land Surveyors of Ohio.

Early in the project, it was discovered that little or no adequate mapping existed for the area in question. Therefore, in addition to providing a listing of the distances and magnetic azimuths between the Stations an accurate map was required. Essentially, the map would have to be compiled "from scratch" and be referenced to a universal datum. This project is still "on-going" and provides an excellent example of the decisions and elements required in the map design process. The Gwynne Conservation Area is owned and operated by the Ohio State University.

The graphic at right is the only available site map.



## Map Planning and Design Considerations:

Map Planning is the process of setting the scope, extent and characteristics of any sub-process involved. The major steps of map planning include purpose, area, projection, datum, scale, data sources and accuracy, and time constraints. Since this project was totally voluntary and equipment was available, there were no budget considerations other than expendables.

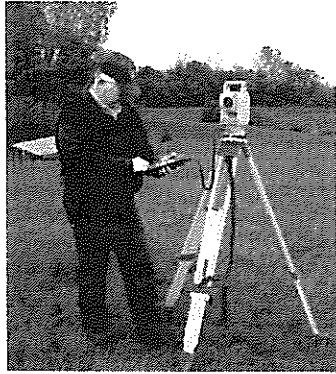
Although the specifications required distances to the nearest foot and magnetic azimuths to the nearest half degree; it was decided that all distance measurements would be made to the nearest one-hundredth of a foot (0.01') and all angular measurements would be made to the nearest five seconds (00° 00' 05"). Moreover, it was decided that all mapping azimuths would be referenced to geodetic and grid north and that the mapping would be referenced to common reference system. The basis for these decisions include the following:

1. Magnetic North has a tendency to wander; therefore a fixed datum is required to quantify the magnetic drift and re-establish the magnetic azimuths of the courses at future dates.
2. It is highly likely that within the near future that hand-held (autonomous) Global Positioning System (GPS) units may be used on the Orienteering Course. Thus the need for true position and higher accuracy.
3. Given the fact that this project was completely voluntary coupled with the fact that the West Jefferson Middle School faculty needed a list of distances and magnetic azimuths between the Stations and a map showing the courses; time collecting positional data on natural and man-made features would have to be minimal. Therefore, it was decided that digital ortho-photographs available from the Madison County Auditors office would be used to "orient" the courses to existing physical objects. Thus the Orienteering Course (Activity Stations) had to be on the same reference system as the digital ortho-photographs.

The purpose, area and accuracy standards (specifications) have been listed. The remaining considerations are listed as follows:

1. Datum: North American Datum 83, NAD 83.
2. Projection: Ohio State Plane Coordinate System, Ohio Zone South.
3. Data Sources: Other than the Madison County Auditor's digital ortho-photographs and the National Geodetic Survey Website, all other data was obtained by field survey methods to the standards as previously discussed.
4. Software: Trimble Geomatics Office, Autodesk Land Development Desktop, Tripod Data Systems (TDS), and MicroSoft Excel.
5. Time Constraints: The delivery date for the Planning Worksheet of the Orienteering Courses and the Map was Wednesday, October 16, 2002.

6. Expendables: Two (2) Bernsten aluminum monuments and caps for primary control. Miscellaneous computer discs and paper for hard-copy.
7. Field Equipment:



Topcon GTS 213 Total Station  
with TDS 48 Data Collector  
(00° 00' 05" Angular Accuracy)



Trimble 4600 LS GPS Unit  
with TSC1 Controller  
(Single Frequency - Survey Grade)

The map design considerations were based on a minimalist approach. Essentially, the digital ortho-photographs provided sufficient spatial data (1 foot pixel resolution) for the purpose of “orienting” the user to the real world. The Stations and Station Identifier or Point Numbers, overlay the raster images. There are four orienteering courses maintained on separate layers in Land Development Desktop and are color-coded the Orienteering List. The remaining items include a Legend, Title Block, Graphic Scale and North Arrow.

### Field Procedures - Spatial Data Collection

Three control reference points were established at the site: Gwynne North and South (Bernsten stainless steel monuments and caps) and IP West (5/8" steel pipe). These were incorporated into a traverse through the Activity Station points. Both a Topcon GTS 213 Total Station with TDS 48 Data Collector and Nikon 720 Total Station using onboard data collection were available for traversing. The information was downloaded using Autodesk Field Survey. Compass azimuths were taken and an assumed coordinate system was used for data reduction and closure. This information is included in a “look-up” table for the Orienteering List (Excel Spreadsheet). The Trimble 4600 LS GPS Unit with TSC1 Controllers were used in differential GPS Static Mode to provide geodetic coordinates for Gwynne North and South and IP West. The Base Unit was established over an NGS Class “B” monument located two kilometers south of the site at the Madison County Airport. Three (3) forty-five minute static sessions were observed. The Base Unit was also processed against the Ohio Department of Transportation CORS sites. Positional error was observed to be less than 0.05 feet.

Primary Geodetic Control - Gwynne North and South are two inter-visible points from which existing or future Activity Stations can be referenced.



## Office Procedures - Data Manipulation

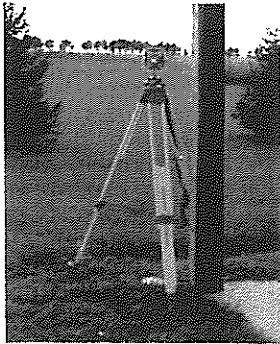
The GPS data was processed in Trimble Geomatics Office (TGO) 1.5 to obtain Ohio SPC South coordinates for Gwynne South, Gwynne North and IP West. TGO was also to translate, rotate and scale the traverse to Ohio SPC values. The traverse was checked against the closing line at IP West of with an error of 0.05 feet. Point symbols were assigned and lines inserted for the GPS triangle and traverse lines. This data exported to a ".dwg" format file and a comma delimited file for all points.

The .dwg file created by TGO was imported into AutoDesk Land Development Desktop (LDD). AutoDesk LDD was used to establish model space/ paper space for plotting the maps. The Madison County Auditor's office provided aerial Photo coverage in "MrSid" format and georeferenced to Ohio SPC South. The image was imported and layers created for each desired course completed the map.

As previously mentioned the point names and original coordinates were entered directly into MS Excel to create an inverse coordinate sheet to compute magnetic azimuths and distances from point to point (Activity Stations).

## Final Map Product

Four maps are attached depicting Orienteering Courses A, B, C and W (Hadicapped). These are the intermediate deliverables to the Gwynne Conservation Area personnel and West Jefferson Middle School faculty. The next product will include creating "hot-links"; whereby, digital images of the Stations can be accessed by clicking on the point (See Below). Later the lesson plans (educational experiences) will also be 'hot-linked: to the map. It is expected that the map will be exported to AutoCAD map, Intergraph Geomedia or ESRI ArcGIS for inclusion into a true GIS.



Approaching Station B-2  
(Along Magnetic Azimuth)



Station B-2

As discussed in the previous section, the interactive Map Design Tool is under development. The attached spreadsheet is the nearest attempt at an interactive tool. In addition to the four courses shown on the attached maps, the user can also develop additional orienteering courses. These of course have to be compared to the original images to ascertain that the course can actually be traversed.