FLATHEAD COUNTY LANDFILL MAPPING

SURV 271
PROJECT PRESENTED 12/16/04

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ABSTRACT

The Flathead County Landfill is located approximately 5 miles north of Kalispell and consists of approximately 345 acres in Section 1, Township 29 North, Range 22 West, and Section 36, Township 30 North, Range 22 West, Principal Meridian, Montana. The area described is owned and operated by Flathead County.

Mapping of the facility was done using Trimble GeoExplorer3 Global Positioning System (GPS) equipment. The data collected was then displayed using various software programs to produce maps with an accuracy of 3-5 meters. The focus of this project is to map features of the Flathead County Landfill that affect groundwater quality within the site.

The data collected and resulting products can be used by citizen groups interested in what steps the Flathead County Landfill is taking towards environmental protection.
# Table of Contents

<table>
<thead>
<tr>
<th>Item</th>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illustrations</td>
<td></td>
</tr>
<tr>
<td>1. Flathead County Landfill Aerial</td>
<td>4</td>
</tr>
<tr>
<td>Photograph W/ Expansion Boundary</td>
<td></td>
</tr>
<tr>
<td>2. Satellite Prediction Data</td>
<td>5</td>
</tr>
<tr>
<td>3. Corrected Vs. Uncorrected Data</td>
<td>6</td>
</tr>
<tr>
<td>4. Map W/ USGS 7 ½ Minute Quad Background</td>
<td>7</td>
</tr>
<tr>
<td>5. Map W/ Digital Ortho Quad Background</td>
<td>8</td>
</tr>
<tr>
<td>6. Landfill Schematic</td>
<td>9</td>
</tr>
<tr>
<td>Introduction</td>
<td>10-11</td>
</tr>
<tr>
<td>Materials and Methods</td>
<td>11</td>
</tr>
<tr>
<td>Results and Discussion</td>
<td>12</td>
</tr>
<tr>
<td>Conclusion</td>
<td>13</td>
</tr>
<tr>
<td>Recommendations</td>
<td>13</td>
</tr>
<tr>
<td>Works Cited</td>
<td>14</td>
</tr>
</tbody>
</table>
FLATHEAD COUNTY LANDFILL BOUNDARY

Figure 1
Prediction data for 10/29/04

Prediction data for 11/02/04
Figure 2

Uncorrected Pathfinder Data For File 102917A

Corrected Pathfinder Data For File 102917A

Figure 3

Uncorrected Pathfinder Data For File 110218A

Corrected Pathfinder Data For File 110218A
FLATHEAD CO. LANDFILL-USGS 7 1/2' QUAD OVERLAY

Figure 4
FLATHEAD CO. LANDFILL - DOQ OVERLAY

Figure 5
MAP PRODUCED WITH LAND DEVELOPMENT DESKTOP

Figure 6
INTRODUCTION:

The Flathead County Landfill is a county-owned waste disposal facility. It is required that such facilities have a network of monitoring wells to track and measure contaminants that have made their way to the underlying aquifer. The objectives of this project are to:

- Map the existing groundwater monitoring wells on site.
- Map both the currently used waste disposal area, as well as the proposed expansion area.
- Map existing roads, storm water ponds, and a household hazardous waste disposal area.
- Give a clear understanding of what measures Flathead County is taking towards environmental protection in the landfill area.

The Flathead County Landfill, as previously mentioned, is a county owned and operated facility. Recent growth in Flathead County has prompted the need for expansion. A typical year shows an average increase of 2-3% in accepted waste weight. During the last year, an increase of 8.5% was observed. Approximately 120 acres have been purchased directly south of the current facility for future expansion. Expanding the licensed boundary is currently under review with the Montana Department of Environmental Quality. Officials hope to expand operations within the next 15-20 years.

Another issue affecting every landfill is groundwater contamination. The main features of the local hydrogeology are shallow, discontinued perched zones of water underlain by a deep regional confined aquifer (Flathead Valley Aquifer). At the Flathead County Landfill, a perched water table exists 30-50 feet below the surface on the north side of the facility. Contamination has been found in this high water table. The sandy gravel material allows for contaminants to make their way from the surface to the water table. To counter this problem, a series of groundwater interceptor wells were installed to pump water out of the perched water table and divert it to a storm water detention pond. These wells were not mapped due to a lack of information as to their location.

Below the perched water table, the Flathead Valley Aquifer exists 200-300 feet below ground surface. All of the monitoring wells are completed in this aquifer for the purpose of groundwater monitoring. Contamination was found several years ago, and as a result, the facility was placed on a Corrective Action Plan (CAP) by the Montana Department of Environmental Quality. The CAP required that quarterly sampling be done at the facility. At the point where all samples indicate that the facility is at or below drinking water standards for 5 years, the CAP is lifted. Currently, drinking water standards are being met and the facility is no longer under the CAP. Biannual monitoring, however, does continue to make sure the engineered controls are working.

The only problem the Flathead County Landfill is experiencing with groundwater contamination is at MW-3, where dichlorofluoromethane exceeds state standards. This chlorinated/flourinated hydrocarbon is indicative of refrigerators and other associated appliances. If one tracks the history of the landfill, it will be discovered that MW-3 is
near the old dumpsite for these types of appliances. The finished maps, as well as this report, will be available to interested parties concerned with environmental protection.

**MATERIALS AND METHODS:**

After hearing some of the horror stories from last year’s projects, I wanted to make sure that everything about my project went smoothly. Before I started, I met with Dave Prunty, director of Flathead County Landfill, to gain some background knowledge of the facility. I also downloaded the Flathead County Solid Waste District 2003 Solid Waste Report available at [www.co.flathead.mt.us](http://www.co.flathead.mt.us) to gain additional resources for my project.

After studying the resources previously gathered, a data dictionary was created in Trimble Pathfinder Office 2.90 to ease the data collection process. The data dictionary was then downloaded to a Trimble GeoExplorer 3 GPS unit. The GeoExplorer 3 was then used to collect test data, which was then uploaded to Trimble Pathfinder Office 2.90 to make sure the data dictionary worked.

Before data collection, the Trimble Pathfinder Office 2.90’s QuickPlan was consulted for satellite prediction (See Figure 2). Due to time restraints on my part and landfill operational hours, the data collection was to be performed on two separate days at two 4-hour intervals on October 29, 2004, and November 2, 2004, respectively.

WGS 84 Data was collected regarding locations of monitoring wells, private/miscellaneous wells, fences/boundaries, roads, storm water retention/detention ponds, and the household hazardous waste (HHW) drop-off area, most of which are directly related to groundwater quality in the immediate vicinity.

The files collected were then differentially corrected in Trimble Pathfinder Office 2.90 using Flathead County’s base station with the following features:

**Latitude:** 114°11’21.98164” N
**Longitude:** 48°18’39.92087” W
**Height Above Ellipsoid:** 2938.221 ft.

After differential correction (See Figure 2, 3), the data was overlaid on a USGS 7 ½ minute Rose Crossing Quad Map (See Figure 4) and a Rose Crossing DOQ (See Figure 5) using ArcView 3.3. A landfill schematic was drafted by overlaying the differentially corrected GPS data on a Rose Crossing DOQ using Land Development Desktop (See Figure 6). Both the USGS 7 ½ minute Quad Map and the DOQ were obtained from the Montana Natural Resources website, [www.nris.state.mt.us](http://www.nris.state.mt.us).
RESULTS AND DISCUSSION:

With the features mapped affecting groundwater at the Flathead County Landfill, the data recorded was compared to measurements taken in the field. For a qualitative check, the distance between monitoring wells 6 and 6D was measured with a cloth tape at 22 feet. The differentially corrected GPS coordinates show a distance of 26.96 feet. This distance is within the expected 3-5 meter horizontal accuracy standards set forth by Trimble. PDOP values were checked randomly in Pathfinder Office. Most of the values showed a PDOP value of 2 or less, indicating great satellite geometry and reception. Only the horizontal positions measured were used in creating a final map. Vertical positions tend to have more error associated with them and were neither used nor needed for this particular project.

When creating the schematic for the landfill, it was important to log data concerning road location. Even though the roads are not directly related to contaminants that may exist under the landfill, they give the viewer a good sense of proximity, hence their purpose for being displayed on the maps.

The fence line surrounding the landfill is an approximate boundary of the facility. The north and northwest boundary of the landfill actually extends to the right-of-way of KM Ranch Road (See Figure 1). Most of the immediate west and south fence lines are a good approximation of the boundary. The southeastern portion of the landfill extends to the right-of-way of US Highway 93. Approximate boundary location was vital to map due to the inevitable expansion in the near future. Three monitoring wells (MW 9, MW 10, and MW 11) have been installed on the south end of the landfill to determine groundwater quality in that vicinity of the landfill. No monitoring data is available at the time of this report.

The fence line was created by recording positions at any major deflection in the fence. This was done to reduce the multipath error that is notorious around chain link fences. Once the fence corner locations were plotted, it was simply a matter of connecting the dots in both ArcView and Land Development Desktop to create a fence line. Another feature that was simply drawn in was the outline of Section 1, Township 29 North, Range 22 West, Principal Meridian, Montana. This was done to make the map more visually enhancing and to put an even tighter location on the facility to the viewer.

All of the maps created in ArcView and Land Development Desktop are displayed in the Montana State Plane Coordinate system (NAD 83 Datum). It was important to make sure everything remained consistent to make sure the WGS 84 data collected matched the georeferenced maps brought into the respective software programs.

When combining the GPS data with data from groundwater monitoring reports, various maps can be generated which can aid the hydrogeologist in determining a remediation plan for contaminated groundwater. These maps include, but are not limited to, an existing landfill schematic, a groundwater flow map, and a plume map of the contaminants. Since there are limited contamination issues, only a schematic was created in both ArcView and Land Development Desktop.
CONCLUSION:

With so many facets to the landfill, it was vital to narrow what needed to be mapped to complete the scope of work for this particular project. It is a very interesting facility, but the focus remained on mapping groundwater-related items. Features other than those involved in monitoring/rehabilitating the groundwater supply (i.e., roads) were mapped to give the viewer a sense of proximity.

A bulk of my time was spent on putting a map together in Land Development Desktop. I am familiar with the program from previous work experience, but I had never developed a project like this one. I was able to set up a coordinate system that would correspond to my exported .dxf file (MT State Plane 83). The only problem I had was fitting a DOQ image to the background. After cropping a selection in IrfanView, I was able to make the image fit the data, only after hours of trial and error. There is a way to allow the geo-referenced DOQ to fit exactly, but the methodology is beyond me.

After putting together the schematic of the landfill reading through monitoring data and the Flathead County Solid Waste Report, it can be shown that the facility is run both efficiently and effectively. This was a great opportunity to observe the differences in a community-owned landfill versus a privately-owned facility. It is my belief that the residents of Flathead County are lucky to have such an operation. Ownership on the county’s behalf allows for the treatment of this facility as a resource, keeping the health and safety of the county’s residents in mind.

RECOMMENDATIONS:

It will be said time and time again that good planning will save a great deal of time. I feel that my project went smoothly, largely in part to my interview with Dave Prunty and the resources available over the Internet. However, spending an hour doing some reconnaissance work with a landfill employee would have helped greatly. Due to a lack of information, I was not able to map the network of groundwater interceptor wells.

Data organization is a must when working on this project. It is important to have files in order to reduce any confusion that may occur. It is also a good idea to create backup files as a safety net. Uncertainty arose in the software used in creating this project, so copious amounts of experimenting took place. Having the backup files ensures the user that a mistake will not result in any loss of data.

I would also recommend not working too far ahead of schedule. So much is learned about the project as the semester carries on that it does not pay to start early. Also, stick to the software programs that are used in the classroom. Vital time was spent learning to handle the data in a different media. Granted, the finished product looks better in Land Development Desktop, but it was not necessary. It was a good experience, but keep in mind that the only map requirement is that the project be presented in ArcView.
WORKS CITED

www.co.flathead.mt.us.
