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CPM PROJECT

DNR NETWORK CONSOLIDATION PLAN



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South Carolina Department of Natural Resources

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DNR NETWORK CONSOLIDATION PLAN

Purpose

Provide an efficient and effective network for the Department of Natural Resources to meet the demanding needs during its consolidation and office closures.

Introduction

The Department of Natural Resources has been hit with a 36 percent budget cut of state appropriated funds over the past three years. The reduction in the Department's budget has resulted in the need to consolidate its offices closing many of its smaller offices across the state. The Deputy Directors and Executive Staff have met and decided to consolidate into four regional office hubs and set a schedule for the closure of offices beginning in September 1, 2003 and ending by January 15, 2005. The closure of various offices and the consolidation of the functions into regional offices will result in the requirement to revamp our network infrastructure.

Network Structure

The first step in any networking project requires a baseline of the current network infrastructure and what type of network connections are being utilized. The DNR consists of three separate networks that were created independently prior to a merger resulting from the S.C. Restructuring Act. The agency as organized on July 1, 1994 under the S.C. Restructuring Act is composed of the former Wildlife and Marine Resources Department, Water Resources Commission (non-regulatory programs), Land Resources Commission (non-regulatory programs), State Geological Survey (State Geologist), and S.C. Migratory Waterfowl Committee. The Marine Resources Department (MRD) in Charleston consists of self supporting network managed by Tim Snoots. Land, Water and Conservation (LWC) managed their own network out of the Devine Street office led by Jim Scurry. The agency's main office on

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Assembly Street in Columbia was managed by David Busby of which I am a part of. The main office consists of members of various departments including Law Enforcement, Boat Titling and Registration, Licensing, Game and Fish and Education department. With the retirement of David Busby, Jim Scurry became the IT Director for the agency and has merged the IT staff from the Devine street office with the Administrative office IT personnel.

The Marine Resources Department's network is based on an Ethernet backbone with Internet connection through the Medical University of South Carolina (MUSC) and the College of Charleston (Figure 1). The network is switched 10/100 Ethernet to the desktop and Gigabit Ethernet backbone. MRD has 3 remote offices at Waddell, Bennett's Point, and Edisto that connect to the Internet through ADSL and to MRD via Virtual Private Network. There are over 250 users within the MRD network using Microsoft Windows products on the desktop. MRD is connected to the Administrative office in Columbia via a 128K frame-relay connection for access to the Unisys mainframe. MRD will remain as an independent network at this time.

Land, Water and Conservation's network (Figure 2) is Ethernet based and connects to the Internet through the Chief Information Office (CIO) MetroNet/Internet connection. The Local Area Network (LAN) consists of a Cisco 5500 switch running 10/100MB to the desktop. Desktops are running Microsoft based operating systems: Windows 95, Windows NT 4.0, Windows 2000 or Windows XP. The users connect to a Windows NT Domain for authentication with an application server housing the primary applications such as Microsoft Office Professional and Word Perfect. Six servers are connected to the LAN to provide file and print services as well as house the department's databases. The department is primarily scientific in nature and uses mapping applications such as Geology Information Services (GIS) and Arc Internet Map Servers. The LAN is protected by a Cisco Pix 515 firewall. This firewall also

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provides a separate LAN for Web based servers on the (Demilitarized Zone) DMZ. The DMZ is a protected area that allows access from the public Internet without compromising the agencies internal LAN. A 64K frame-relay circuit connects the Devine street network to the network on Assembly Street for access to the Unisys mainframe.

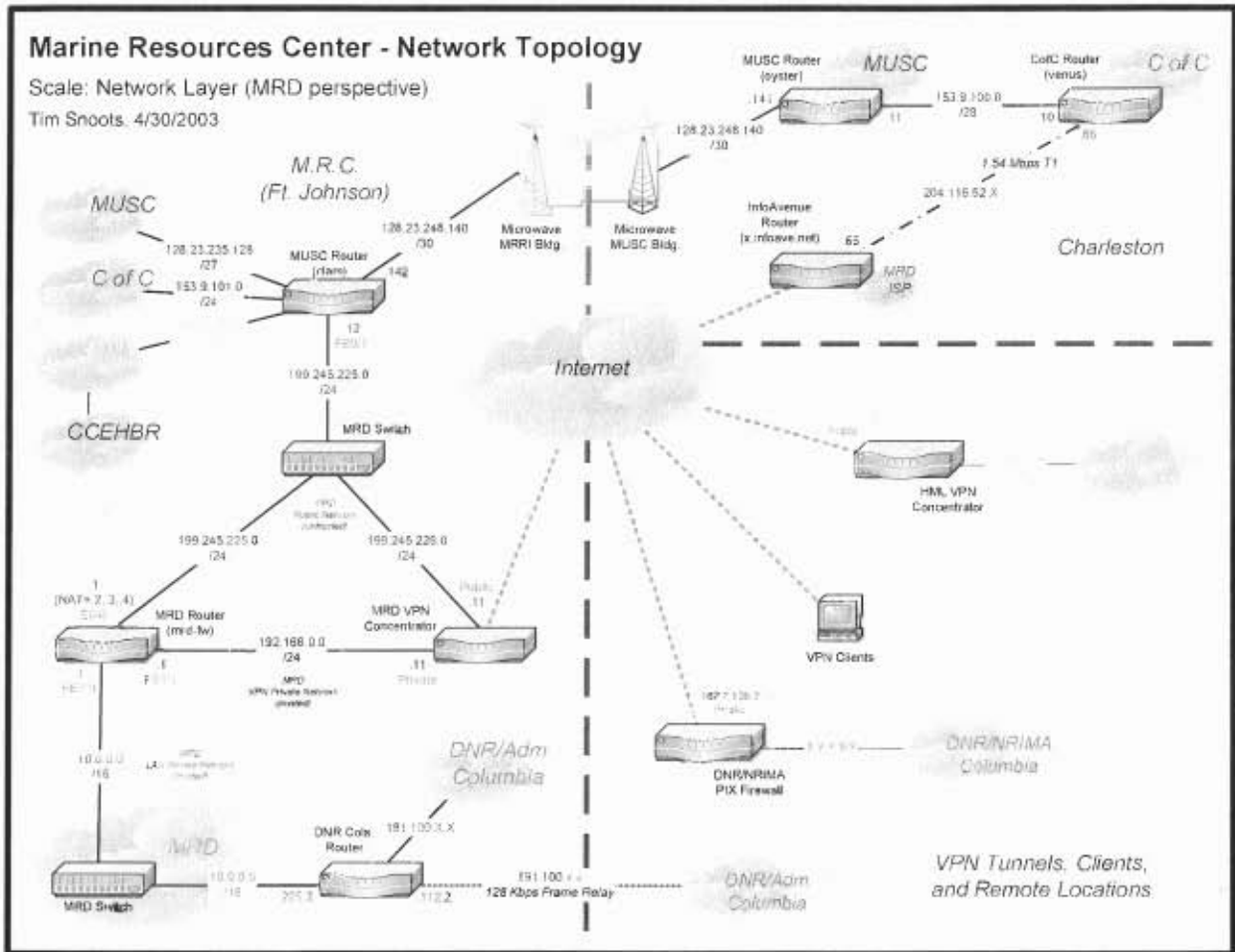


Figure 1 MRD Network Topology

Land, Water and Conservation
Devine Street Network

Network Administrator: Floyd Stayner

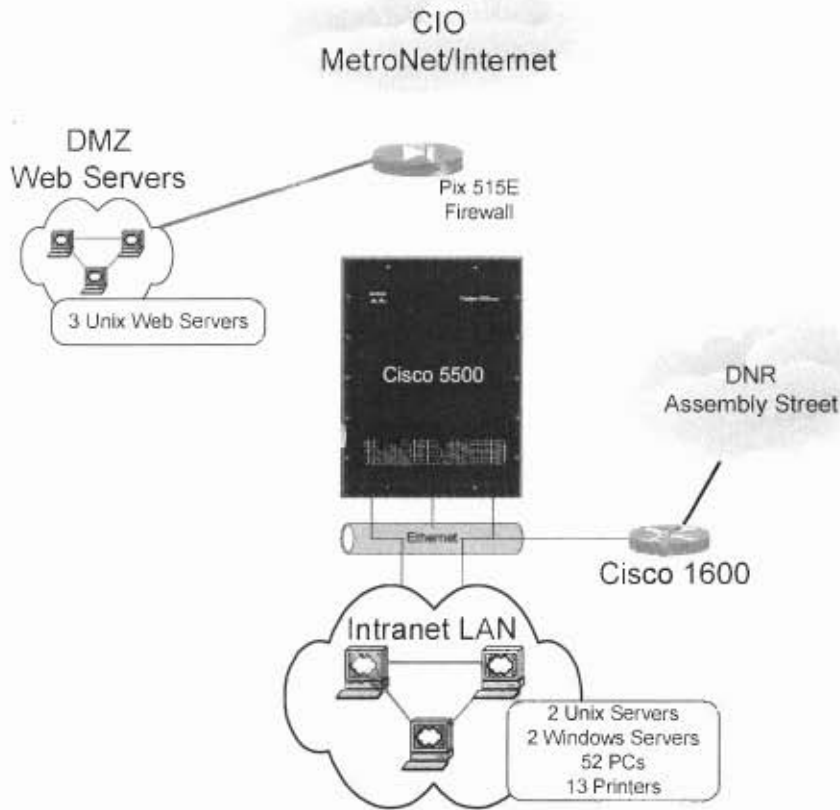


Figure 2 LWC Network Topology

The main office network is switched Ethernet network (Figure 3) utilizing Cisco, 3Com and Extreme Networks equipment. An Extreme Networks Summit 4 is the core of the network and provides a Gigabit backbone to Cisco 2900 series switches in each of the wiring closets in the Dennis building. 3Com 10MB hubs are still being used to supplement the additional devices on the network. Hubs are obsolete equipment and are being replaced as funds are available with Cisco switches. The switches and hubs provide a 10/100MB connection via CAT5 cable to each end station on the network.

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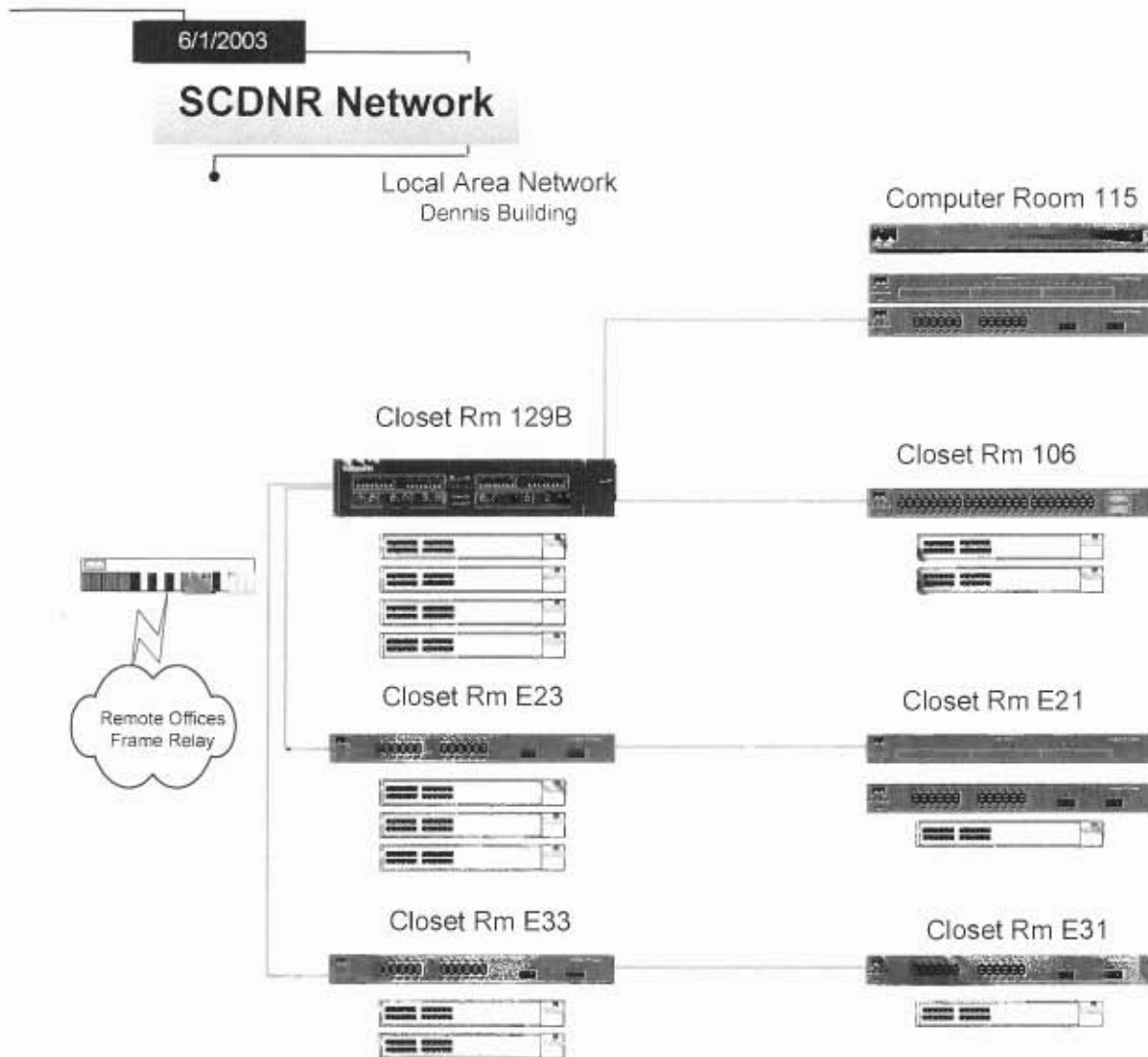


Figure 3 Dennis Building Network Topology

A Wide Area Network (WAN) (Figure 4) provides connectivity to remote offices across the state. There are 16 remote sites that are connected via frame-relay. A Cisco 2501 router at the Dennis building with a T-1 connection is the central hub for the WAN. Each remote office contains a Cisco 1600 series router with a 64 or 128K link. The remote offices utilize a 10MB hub to connect the end devices. The remote offices access the main office through this connection for Internet, email, mainframe and file sharing. Also connected with a T-1 frame-relay is the SLED/NCIC network. NCIC is a database that ties law enforcement information into

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a central location. In addition to the frame-relay connection, a Cisco 3005 Concentrator provides access to the main office using Virtual Private Network (VPN) technology. Remote users have the ability to use the Internet via a local Internet Service Provider (ISP) to access the network. The remote users include the County Auditors and Tax Collectors in the state to access the Watercraft database on the Unisys mainframe. The WAN is protected by a Cisco Pix 515 firewall with Virtual Private Network (VPN) capability. The VPN module on the Pix allows for entire networks to be linked securely across the Internet.

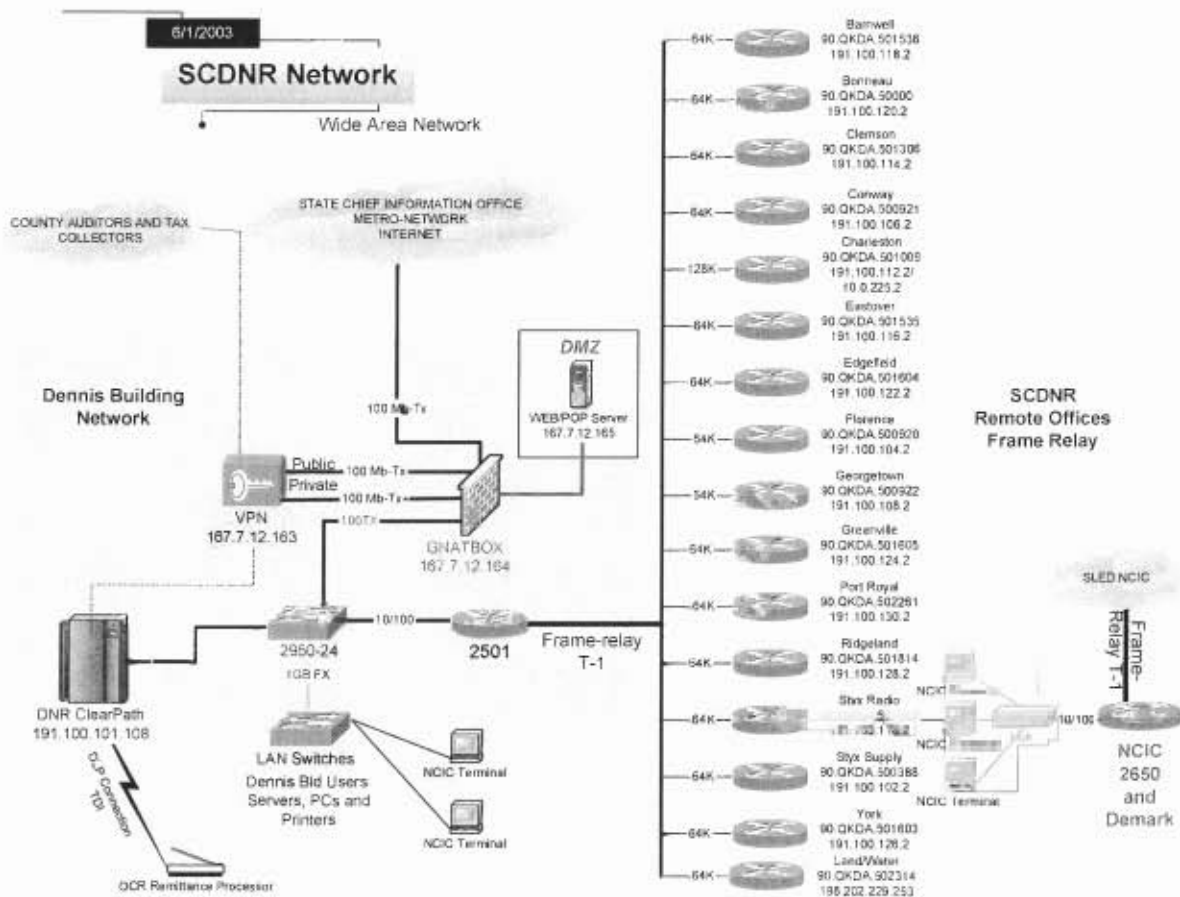


Figure 4 Assembly Street WAN Topology

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Networking costs are very difficult to compile based on the variety of services available and the varying procedures by which each office can purchase them. The network costs depicted in Appendix A represent costs associated with offices with a true network structure. There are many individuals who have individual Internet accounts that can get into the network, but those costs are not calculated for this exercise. Networking costs can be individual bills or combined as part of telephone or cable service. Bills that combine multiple services contain taxes and service fees that are not tied to specific circuits or connection and have been excluded from the calculation. Also, IT staff salaries, training and support expenses are not included. The charges are broken down into the type of service provided by location. Frame-relay charges are billed by the telephone company and are based on bandwidth and distance to CIO's state data network. Dial up and Fast Access service is billed by the local ISP and ranges based on the number of users or bandwidth and can require dedicated phone lines. CIO has three separate charges that it bills the agency based on bandwidth and type of connection. MetroNet is the state data network charge that applies to a direct point of presence on the network. Internet charges apply to any MetroNet connection that leaves the state data network. WAN charges are based on bandwidth for the frame-relay connections to ride the state data network. Router maintenance charges provide manufacture support or replacement in the event a router needs service. The current cost for these services is \$5,464.97a month or \$65,579.64 per year.

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Office Closures

The Deputy Directors and Executive staff made decisions to close a number of DNR facilities including 10 locations with frame-relay connections into the main DNR office and move towards regional offices (Figure 5). Charlie Garvin from the Law Enforcement division provided a schedule (Table 1) for the closings and coordinated the overall activities and logistics

| Proposed Office Closures | |
|---------------------------------|----------------------|
| Office | Date Closed |
| LE - Hampton | 9/1/2003 |
| LE - Parler Station, St. George | 9/1/2003 |
| LE - Conway | 1/15/2005 |
| LE - Ridgeland | 9/1/2003 |
| LE - Port Royal | 9/1/2003 |
| LE - Georgetown | 9/1/2003 |
| LE - Cox Station, Edgefield | 9/1/2003 |
| LE - York Station, York | 9/1/2003 |
| LE - Greenville | potential relocation |
| LE - Dennis Center, Bonneau | 9/1/2003 |
| LE - Barnwell | 9/1/2003 |
| WFF - Union | ? 7/1/2004 |
| WFF - Greenwood | ? 7/1/2004 |
| WFF - Eastover | 7/1/04 |
| WFF - Newberry Hatchery | 1/1/2004 |
| WFF - Monticello trailer | 9/1/2003 |
| WFF - Barnwell Hatchery | 9/1/2003 |
| WFF - Santee Coastal | 9/1/2003 |

Table 1 Office Closures

employees and their computer equipment were moved to the Waddell center. The Waddell center is under the direction of the Marine Resources Department. The Georgetown office was closed on September 23, 2003 with the staff moving to the Samworth office. The Samworth office does not have a network and each PC was setup with Dial Up access to a local ISP. With the closing of these offices, each frame-relay circuit was disconnected resulting in cost savings for the circuit, CIO charges and router maintenance fees. The offices in Conway, York, Bonneau, and

associated. As the network administrator, I am responsible for disconnecting the network circuits and removal of related equipment. Of the 10 offices scheduled for closing, only 4 have been closed to date. The Edgefield office was closed on August 26, 2003 and all computers and network hardware were removed from the building. Port Royal and Ridgeland closed on August 27, 2003 and the

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Barnwell are still under review and closure has been postponed. The 4 offices closing have created a network cost savings to \$1,010.44 per month.

Proposed DNR Offices

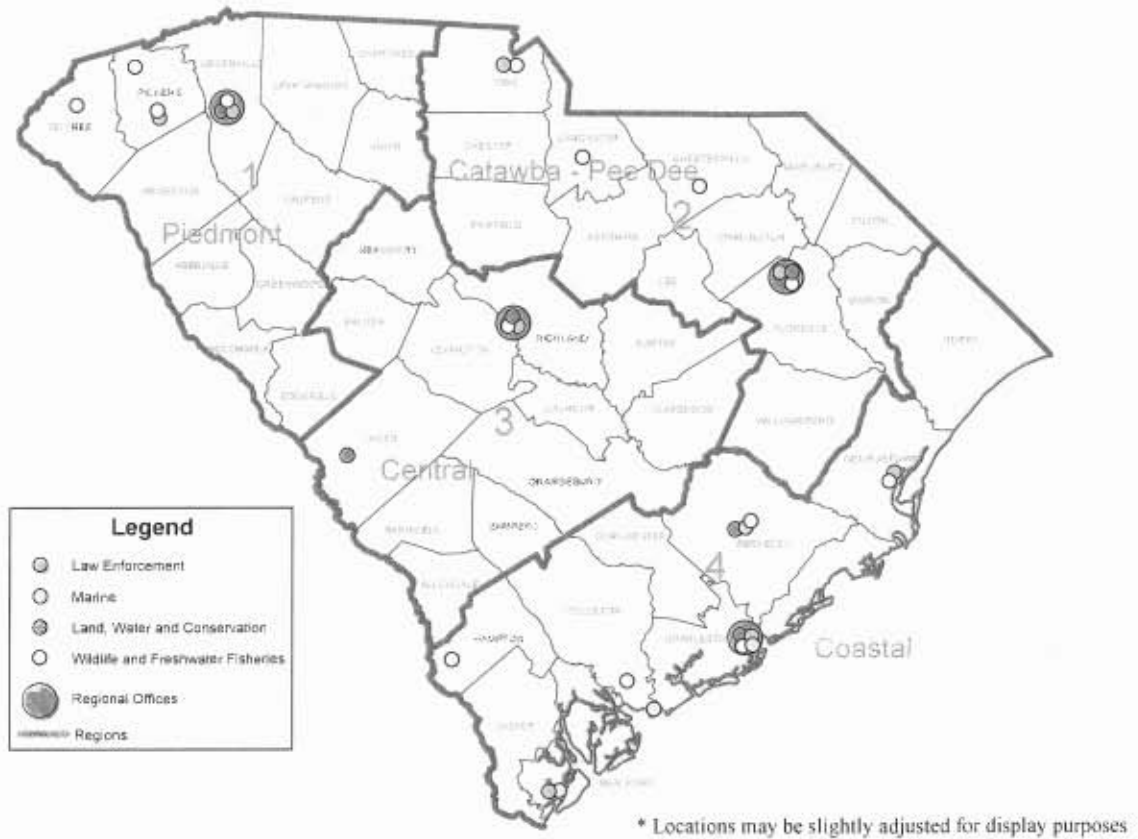


Figure 5 Proposed DNR Office Regions

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Office Consolidation

As a result of the office closings, several individuals took advantage of a separation incentive offered by the agency while others were relocated into existing offices. Several Law Enforcement officers relocated to the Greenville and York offices requiring additional network resources. These offices are currently operating within the frame-relay network and did not require new circuits; however, they did require additional CAT5 wiring within the office. Greenville acquired 3 new personnel requiring network connections and York required 1. CAT5 cable, connectors and wall plates were ordered and installed by an assistant and me to save on costs. The cost of materials was \$175.48 through the State Budget and Control Board.

In addition to the office consolidation, the main office IT department and LWC's IT staff were merged. To help facilitate this merger and reduce maintenance, the data networks are being migrated into one. With the help of the Chief Information Office (Figure 6), the Geology office and Devine street office networks are being connected directly to the Dennis building network. The technology uses CIO's backbone to deliver a direct Layer 2 connection between the buildings using Virtual Local Area Network (VLAN). Instead of having 3 separate network connections and the related charges, there is a single Internet connection out of the main office. This provides greater security through the Pix firewall as a single point of presence to the outside world. The direct connection provides the appearance of a single network to end users allowing for single sign-on authentication and direct access to all network services including file and print sharing, email and mainframe access. Several meetings were held with CIO staff to determine the best migration path with least interruption of services. The Geology office was determined to be the easiest sight to migrate and would affect only 10 users. The Devine street office provides a

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more complex situation and requires a physical move of the web servers and affects 70 users.

Three phases were determined to turn-up Geology to the Layer 2 connection.

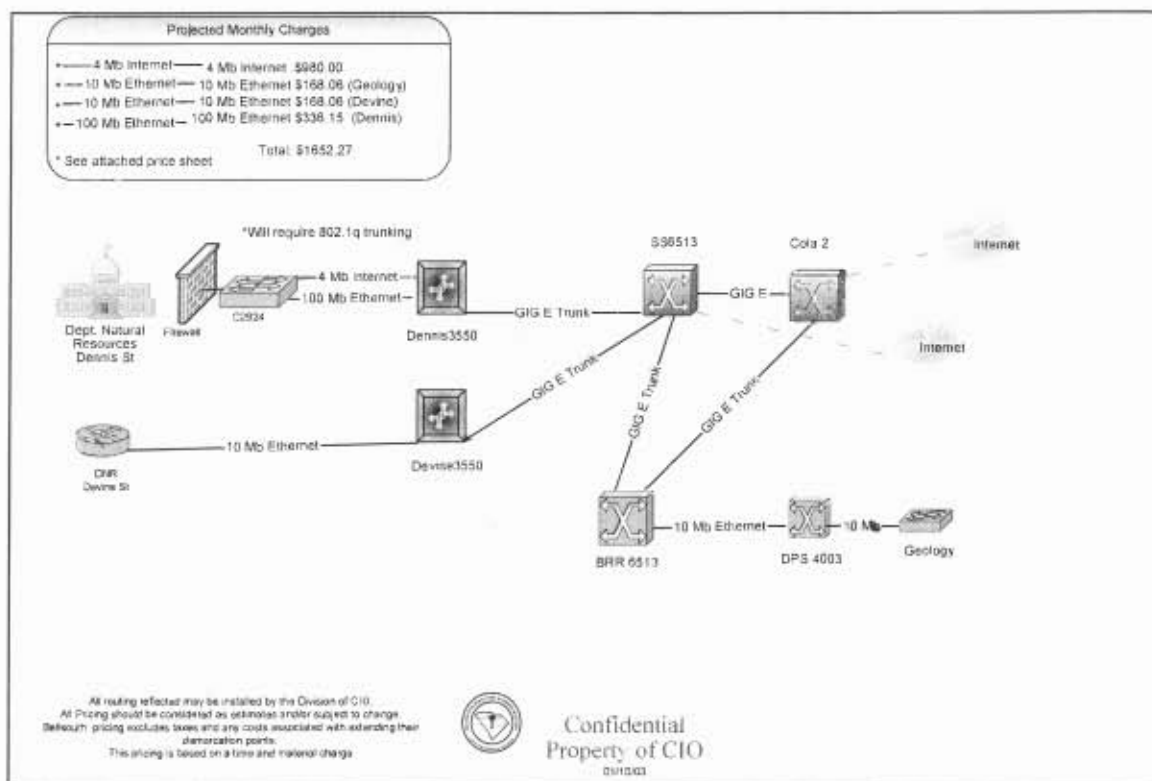


Figure 6 CIO Proposed Layer 2 VLAN

Phase 1 begins with Bobby Boyd, CIO, mapping the Layer 2 VLAN circuit connection across the state data network. Bobby Boyd is our technical point of contact for this project. The connection is a new VLAN circuit from CIO's presence at the Geology office to the Dennis buildings. The VLAN at the Dennis building connect to a switch and is routed through a new interface on Pix firewall into the network. Once the circuit is in place and tested, the current Internet circuit for Geology would be moved to the new parallel Layer 2 circuit. During this period, users at Geology would not be able to connect to the Internet until phase 1 is completed. Once the new circuit is active, the Geology network would require a new IP address scheme. The IP address of the Geology server will be modified and Dynamic Host Control Protocol (DHCP)

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enables an IP address scope for the buildings users. Each device on the network can request network information from a DHCP server without a technician's intervention. Once the devices renew their network information, they will receive a new IP address and all the specifics required to talk on the new network from the DHCP server. Each PC will be checked to verify its connection to the network and checked for 3 things: Internet access, Server access and printer access. Network printers will be check to ensure they are receiving the correct IP address scheme.

Phase 2 involves the migration of the Geology users to the Dennis building Domain. Lincoln Arroyo, DNR IT Domain Administrator, is assigned the duties to complete and test this phase of the project. A migration strategy is to be created to determine the necessary steps and any concerns for the consolidation of user's accounts to the Dennis building Domain. The strategy will include testing using a spare PC and include merging Windows profiles as necessary. Once the strategy is completed, a day will be scheduled to migrate the users to the Dennis building domain.

Phase 3 includes adding the Geology users to the Dennis building email system. This phase is proposed, but has not been approved by management.

Phase 1 was completed for Geology in November, 2003 and the direct Internet connection for the office has been removed. Geology is now protected by the Dennis building firewall and can access information located on the Dennis building LAN. Phase 2 is still in process. The migration strategy has been proven on a test workstation that was manually configured. Although this is not a difficult process for 10 users, it will be for the Devine street office. Lincoln is working on a strategy that will move all users to the Dennis building domain

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without manual intervention. Commercial Off-the-Shelf (COTS) applications are under review and being tested.

Devine Street migration to Layer 2 VLAN connection will follow the same 3 phases with the addition of moving the web and email servers to the Dennis building. The IP addresses will be changed on the servers to meet the Dennis building IP addressing scheme and the (Domain Naming System) DNS records will be changed by CIO. DNS enables an IP address to be mapped to common alphanumeric names for easy identification. CIO maintains the servers involved with publicizing our existence to the Internet.

The Devine street migration has not begun at this time. The Devine street network administrator has had some family medical emergencies that have required him to be out of the office for most of the last 2 months. His assistance is required for the web and email server moves which are necessary prior to Layer 2 installation. In the interim, a VPN tunnel was created between the Dennis building Pix and the Devine Street Pix to allow network traffic in the respective networks.

Costs for Internet/MetroNet connections actually increase as a result of the VLAN connections from \$1,496.00 to \$1,786.00 per month. The increase is primarily due to the change in service type from 1 MB MetroNet to a 10MB VLAN rate at Geology and Devine and the additional 100MB connection at the Dennis building. The service type increase the bandwidth by a factor of 10 for \$290 a month difference. Additional cost savings are incurred with centralized servers and the ability to reduce on-site troubleshooting.

Conclusion

Considerable effort is made to ensure the DNR network provides efficient and effective access to any required resources across the state. During budget cuts and office closures,

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maintaining a high level of accessibility during transitions is very difficult. To add to the difficulty, changes in leadership can create confusion due to changes in direction for the agency. The plans for office closures changed constantly and are still changing today. Out of the 10 offices with networks scheduled to close, only 4 have closed to date. Employees that belonged in one department requiring access to certain resources changed departments which required different access. In addition to the office closures, the IT departments were being merged. The merger created a new set of issues with organization restructuring, changes in responsibilities and reporting procedures. Through the many changes, we were able to create a lower cost network and provide greater access to all network resources. The network is a living system that is always changing. Figure 7 and 8 depicts the current view of the Local Area Network and Wide Area network respectively. Appendix B shows the current costs of the network with an overall savings to date of \$981.73 per month or \$1,780.80 per year. Cost savings should continue as more offices close, but cost savings are not the primary motivation of the DNR IT department. New technologies and alternatives to high cost network connections are always being reviewed to enhance the DNR network. Cable and DSL Fast Access technology is being implemented at remote offices to lower these costs where the service is available. There are still many network projects on the horizon to replace outdated equipment including the hubs shown in Figure 7. In addition, MRD will be merged into the Dennis building network creating one large WAN managed from a single location. Once this is completed, the agency will encompass a single point of presence to the agency's customer. These projects will take considerable time, research and funds to provide the necessary service to the agency.

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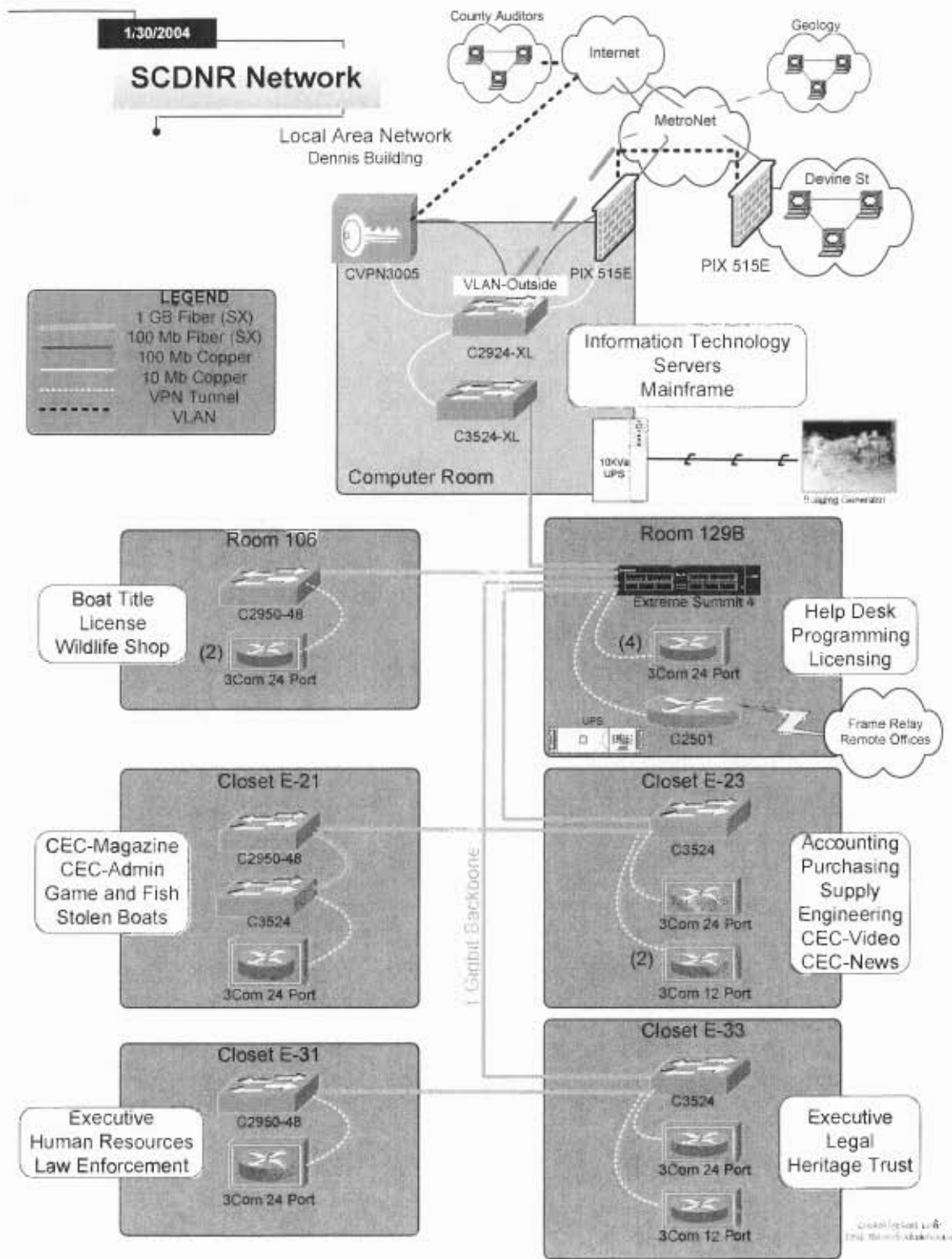


Figure 7 Current DNR Network

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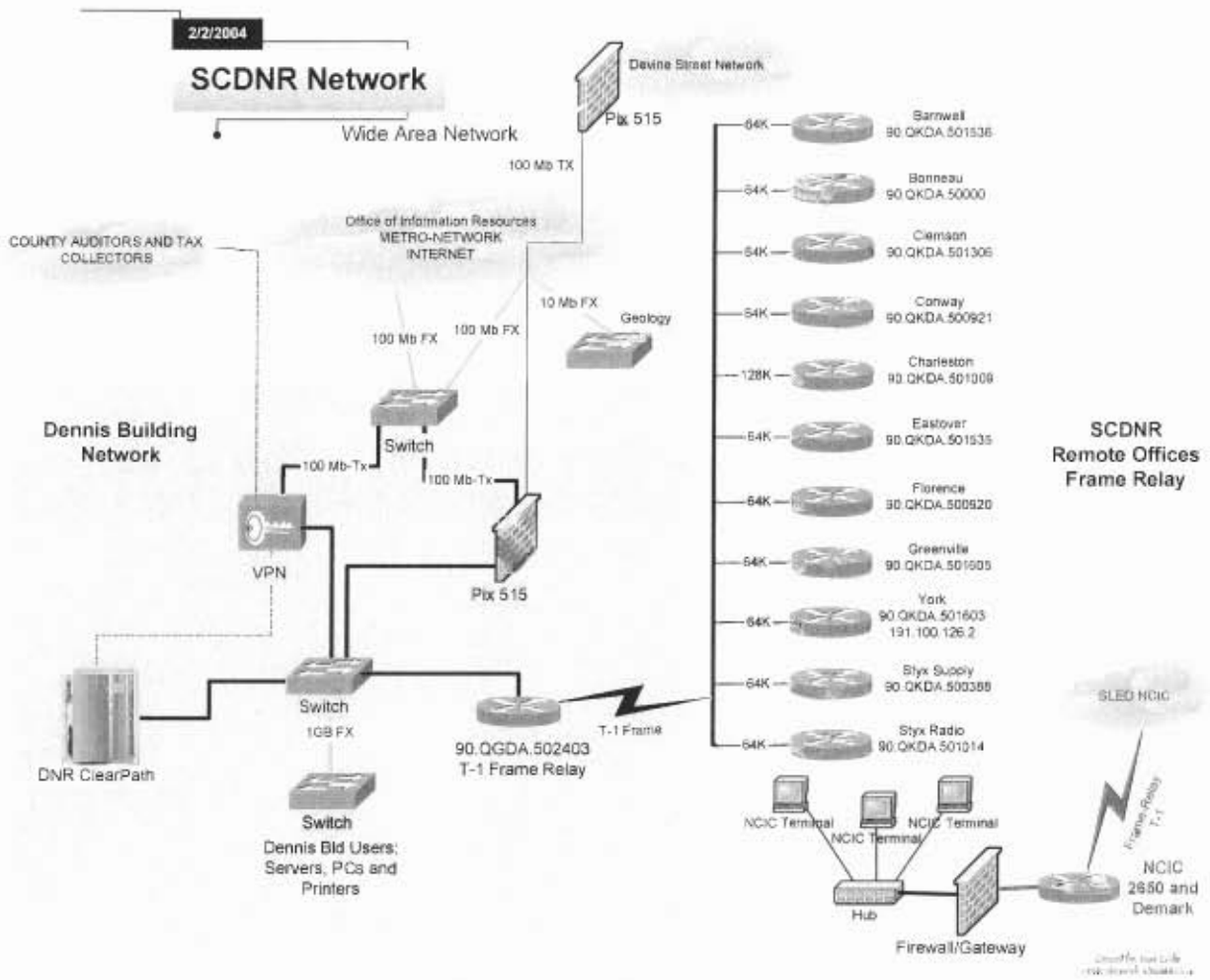


Figure 8 DNR WAN Topology

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APPENDIX A

| Location | Frame Relay | | | Dial UP | Fast Access | CIO Charges | | | Router | Monthly | Yearly |
|----------------------------|-------------|----------|----------|----------|-------------|-------------|------------|----------|----------|------------|--------------------|
| | 64K | 128K | T-1 | Account | DSL/Cable | MetroNet | Internet | WAN | Maint. | Total | Total |
| Columbia Office | | | \$482.19 | | | \$110.00 | \$219.00 | | | \$811.19 | \$9,734.28 |
| Barnwell LE Office | \$130.47 | | | | | | | \$20.00 | \$11.00 | \$161.47 | \$1,937.64 |
| Bonneau | \$136.50 | | | | | | | \$20.00 | \$11.00 | \$167.50 | \$2,010.00 |
| Clemson | \$117.30 | | | | | | | \$20.00 | \$11.00 | \$148.30 | \$1,779.60 |
| Conway LE Office | \$200.93 | | | | | | | \$20.00 | \$11.00 | \$231.93 | \$2,783.16 |
| Charleston LE Office | | \$241.30 | | | | | | \$35.00 | \$11.00 | \$287.30 | \$3,447.60 |
| Eastover | \$116.76 | | | | | | | \$20.00 | \$11.00 | \$147.76 | \$1,773.12 |
| Edgefield LE Office | \$119.45 | | | | | | | \$20.00 | \$11.00 | \$150.45 | \$1,805.40 |
| Florence LE Office | \$117.78 | | | | | | | \$20.00 | \$11.00 | \$148.78 | \$1,785.36 |
| Georgetown LE Office | \$283.84 | | | | | | | \$20.00 | \$11.00 | \$314.84 | \$3,778.08 |
| Greenville LE Office | \$118.60 | | | | | | | \$20.00 | \$11.00 | \$149.60 | \$1,795.20 |
| Port Royal LE Office | \$227.50 | | | | | | | \$20.00 | \$11.00 | \$258.50 | \$3,102.00 |
| Ridgeland LE Office | \$255.70 | | | | | | | \$20.00 | \$11.00 | \$286.70 | \$3,440.40 |
| Styx LE Radio Center | \$116.76 | | | | | | | \$20.00 | \$11.00 | \$147.76 | \$1,773.12 |
| Styx Supply&Equip | \$116.76 | | | | | | | \$20.00 | \$11.00 | \$147.76 | \$1,773.12 |
| York LE Office | \$117.78 | | | | | | | \$20.00 | \$11.00 | \$148.78 | \$1,785.36 |
| Devine St: LWC Office | \$120.24 | | | | | \$129.00 | \$709.00 | \$20.00 | \$11.00 | \$989.24 | \$11,870.88 |
| Broad River Rd: Geology | | | | | | \$110.00 | \$219.00 | | | \$329.00 | \$3,948.00 |
| Greenwood WFF Office | | | | \$203.20 | | | | | | \$203.20 | \$2,438.40 |
| Union WFF Office | | | | | \$69.96 | | | | | \$69.96 | \$839.52 |
| Rock Hill Fisheries Office | | | | | \$69.00 | | | | | \$69.00 | \$828.00 |
| Webb Center | | | | \$46.00 | | | | | | \$46.00 | \$552.00 |
| Donneley WMA | | | | | \$49.95 | | | | | \$49.95 | \$599.40 |
| Total Charges | \$2,296.37 | \$241.30 | \$482.19 | \$249.20 | \$188.91 | \$349.00 | \$1,147.00 | \$335.00 | \$176.00 | \$5,464.97 | \$65,579.64 |

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APPENDIX B

| Location | Frame Relay | | | Dial UP | Fast Access | CIO Charges | | | Router | Monthly | Yearly |
|----------------------------|-------------|----------|----------|----------|-------------|-------------|----------|----------|---------|------------|--------------------|
| | 64K | 128K | T-1 | Account | DSL/Cable | MetroNet | Internet | WAN | Maint. | Total | Total |
| Columbia Office | | | \$482.19 | | | \$586.00 | \$980.00 | | | \$2,048.19 | \$24,578.28 |
| Barnwell LE Office | \$130.47 | | | | | | | \$20.00 | \$11.00 | \$161.47 | \$1,937.64 |
| Bonneau | \$136.50 | | | | | | | \$20.00 | | \$156.50 | \$1,878.00 |
| Clemson | \$117.30 | | | | | | | \$20.00 | | \$137.30 | \$1,647.60 |
| Conway LE Office | \$200.93 | | | | | | | \$20.00 | | \$220.93 | \$2,651.16 |
| Charleston LE Office | | \$241.30 | | | | | | \$35.00 | | \$276.30 | \$3,315.60 |
| Eastover | \$116.76 | | | | | | | \$20.00 | | \$136.76 | \$1,641.12 |
| Florence LE Office | \$117.78 | | | | | | | \$20.00 | | \$137.78 | \$1,653.36 |
| Greenville LE Office | \$118.60 | | | | | | | \$20.00 | | \$138.60 | \$1,663.20 |
| Styx LE Radio Center | \$116.76 | | | | | | | \$20.00 | | \$136.76 | \$1,641.12 |
| Styx Supply&Equip | \$116.76 | | | | | | | \$20.00 | | \$136.76 | \$1,641.12 |
| York LE Office | \$117.78 | | | | | | | \$20.00 | | \$137.78 | \$1,653.36 |
| Devine St: LWC Office | | | | | | \$110.00 | | | | \$110.00 | \$1,320.00 |
| Broad River Rd: Geology | | | | | | \$110.00 | | | | \$110.00 | \$1,320.00 |
| Greenwood WFF Office | | | | \$203.20 | | | | | | \$203.20 | \$2,438.40 |
| Union WFF Office | | | | | \$69.96 | | | | | \$69.96 | \$839.52 |
| Rock Hill Fisheries Office | | | | | \$69.00 | | | | | \$69.00 | \$828.00 |
| Webb Center | | | | \$46.00 | | | | | | \$46.00 | \$552.00 |
| Donneley WMA | | | | | \$49.95 | | | | | \$49.95 | \$599.40 |
| Total Charges | \$1,289.64 | \$241.30 | \$482.19 | \$249.20 | \$188.91 | \$806.00 | \$980.00 | \$235.00 | \$11.00 | \$4,483.24 | \$53,798.88 |