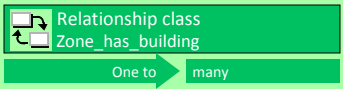


Appendix A

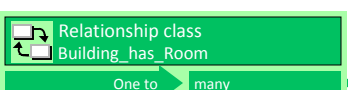
Simple feature class
PUK_Zones

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length
OBJECTID	Object ID						
SHAPE	Geometry	Yes					
Unique_ID	String	Yes					50
Number_of_buildings	Long integer	Yes			0		
Shape_Length	Double	Yes			0	0	
Shape_Area	Double	Yes			0	0	



Simple feature class
PUK_Buildings

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length
OBJECTID	Object ID						
SHAPE	Geometry	Yes					
Unique_ID	String	Yes					50
Zone_ID	Long integer	Yes			0		
Name_of_Building	String	Yes					50
Faculty	Long integer	Yes		Faculty	0		
Department	Long integer	Yes		Department	0		
Number_of_Floors	Long integer	Yes			0		
SHAPE_Length	Double	Yes			0	0	
SHAPE_Area	Double	Yes			0	0	

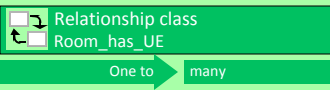


Simple feature class
PUK_Rooms

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length
OBJECTID	Object ID						
SHAPE	Geometry	Yes					
Unique_ID	String	Yes					50
Building_ID	Long integer	Yes			0		
Space_Type	Long integer	Yes		Space_Type	0		
Owner_ID	Long integer	Yes			0		
Capacity	Long integer	Yes			0		
Floor	Long integer	Yes	3		0		
SHAPE_Length	Double	Yes			0	0	
SHAPE_Area	Double	Yes			0	0	

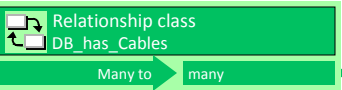
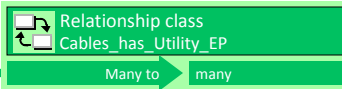
Polygon feature class
PUK_Rooms

Subtypes are Sub_Floor_01, Sub_Floor_02, Ground_Floor, Floor_01, Floor_02, Floor_03, Floor_04, Floor_05, Floor_06, Floor_07, Floor_08, Floor_09, Floor_10



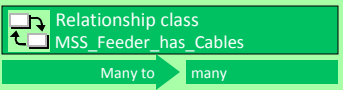
Simple feature class
Cables

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length
OBJECTID	Object ID						
SHAPE	Geometry	Yes					
Unique_ID	String	Yes					50
Job_ID	Long integer	Yes			0		
Ring_Feeder	Long integer	Yes		Ring_Feeder	0		
Sup_DB	Long integer	Yes			0		
Sup_MS_Feeder	Long integer	Yes			0		
Sup_DS_Feeder	Long integer	Yes			0		
Sup_DS_Transformer	Long integer	Yes			0		
Cable_Material	Long integer	Yes		Cable_Materials	0		
Cable_Size	Long integer	Yes		Cable_Sizes	0		
Cable_Composition	Long integer	Yes		Cable_Composition	0		
Outside_Diameter	String	Yes					50
Termination	String	Yes					50
SHAPE_Length	Double	Yes			0	0	
Cable_Position	Long integer	Yes	0				



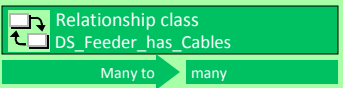
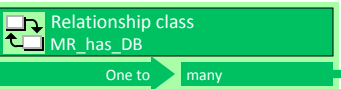
Line feature class
Cables

Subtypes are Sub_Floor_01, Sub_Floor_02, Ground_Floor, Floor_01, Floor_02, Floor_03, Floor_04, Floor_05, Floor_06, Floor_07, Floor_08, Floor_09, Floor_10, Outside



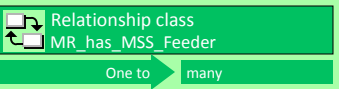
Simple feature class
Main_Substation_Feeder

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length
OBJECTID	Object ID						
SHAPE	Geometry	Yes					
Unique_ID	String	Yes					50
Job_ID	Long integer	Yes			0		
Label	String	Yes					50
Circuit_Breaker_Type	Long integer	Yes		Circuit_Breaker_Type	0		
Circuit_Breaker_Make	String	Yes					50
Current_Rating	String	Yes					50
Fault_Level	String	Yes					50
Voltage_Rating	String	Yes					50



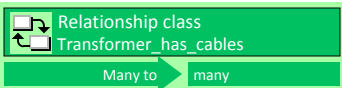
Simple feature class
Distribution_Station_Feeder

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length
OBJECTID	Object ID						
SHAPE	Geometry	Yes					
Unique_ID	String	Yes					50
Job_ID	Long integer	Yes			0		
Type	Long integer	Yes	0		0		
Label	String	Yes					50
Circuit_Breaker_Type	Long integer	Yes		Circuit_Breaker_Type	0		
Circuit_Breaker_Make	String	Yes					50
Current_Rating	String	Yes					50
Fault_Level	String	Yes					50
Voltage_Rating	String	Yes					50



Point feature class
Distribution_Station_Feeder

Subtypes are Sub_Station, Mini_Sub_Station



Simple feature class
Distribution_Station_Transformer

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length
OBJECTID	Object ID						
SHAPE	Geometry	Yes					
Unique_ID	String	Yes					50
Job_ID	Long integer	Yes			0		
Label	String	Yes					50
Primary_Voltage	Long integer	Yes			0		
Secondary_Voltage	Long integer	Yes			0		
Rating_kVA	Long integer	Yes			0		
Vector_Group	String	Yes					50
Impedance	String	Yes					50
Make	String	Yes					50
Year_of_Manufacture	Date	Yes			0	0	8
Oil_Level	String	Yes					50
Silica_Gel	String	Yes					50

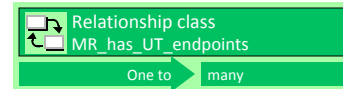
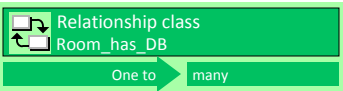


Table
Owners_Table

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length
OBJECTID	Object ID						
Owner_ID	Long integer	Yes			0		
Owner_Name	String	Yes					50
Tel_Number	String	Yes					50
E_mail	String	Yes					50
Department	Long integer	Yes		Department	0		

Simple feature class
Distribution_Board

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length
OBJECTID	Object ID						
SHAPE	Geometry	Yes					
Unique_ID	String	Yes					50
Job_ID	Long integer	Yes			0		
Room_ID	Long integer	Yes			0		
kA_Rating	Long integer	Yes			0		
Phase_Rotation	Long integer	Yes		Phase_Rotation	0		
Phase	Long integer	Yes		Phase	0		
DB_Location	Long integer	Yes	2		0		
Board_Type	String	Yes					50



Point feature class
Distribution_Board

Subtypes are Sub_Floor_02, Sub_Floor_01, Ground_Floor, Floor_01, Floor_02, Floor_03, Floor_04, Floor_05, Floor_06, Floor_07, Floor_08, Floor_09, Floor_10

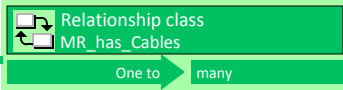


Table
Maintenance_Register

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length
OBJECTID	Object ID						
Contractor_ID	Long integer	Yes			0		
Install_Date	Date	Yes			0	0	8
Utility_Component	String	Yes					50
Last_Updated	Date	Yes			0	0	8

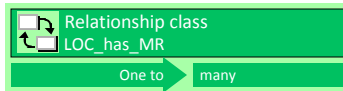


Table
List_of_Contractors

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length
OBJECTID	Object ID						
Contractor_Name	String	Yes					50
Occupation	String	Yes					50
Contractor_Tel_nr	String	Yes					50
Email	String	Yes					50
Company	String	Yes					50
Campus	String	Yes					50
Fax_nr	String	Yes					50

Appendix A

This diagram illustrates all the participating features classes, subtypes and relationship classes inside the PUK geodatabase.

Geodatabase schema diagram

This diagram was auto-generated by the Geodatabase Diagrammer application sample and contains graphic elements that you can use to produce a data model diagram. This sample is available from the ArcScripts site on www.esri.com. You can find examples of finished data model diagrams at the data model section of arconline.esri.com.

Appendix B

Simple feature class PUK_Zones									
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale	Length	Geometry Polygon Contains M values: Yes Contains Z values: Yes	
OBJECTID	Object ID								
Shape	Geometry	Yes							
Unique_ID	String	Yes					50		
Number_of_buildings	Long integer	Yes			0				
Shape_Length	Double	Yes			0	0			
Shape_Area	Double	Yes			0	0			

Simple feature class PUK_Buildings									
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale	Length	Geometry Polygon Contains M values: No Contains Z values: Yes	
OBJECTID	Object ID								
SHAPE	Geometry	Yes							
Unique_ID	String	Yes					50		
Zone_ID	Long integer	Yes			0				
Name_of_Building	String	Yes					50		
Faculty	Long integer	Yes		Faculty	0				
Department	Long integer	Yes		Department	0				
Number_of_Floors	Long integer	Yes			0				
SHAPE_Length	Double	Yes			0	0			
SHAPE_Area	Double	Yes			0	0			

Simple feature class PUK_Rooms									
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale	Length	Geometry Polygon Contains M values: No Contains Z values: Yes	
OBJECTID	Object ID								
SHAPE	Geometry	Yes							
Unique_ID	String	Yes					50		
Building_ID	Long integer	Yes			0				
Space_Type	Long integer	Yes		Space_Type	0				
Owner_ID	Long integer	Yes			0				
Capacity	Long integer	Yes			0				
Floor	Long integer	Yes	3		0				
SHAPE_Length	Double	Yes			0	0			
SHAPE_Area	Double	Yes			0	0			

Subtypes of PUK_Rooms									
Subtype field: Floor									
Default subtype: 3									
List of defined default values and domains for subtypes in this class									
Subtype Code	Subtype Description		Field name	Default value	Domain				
0	Sub_Floor_01	→	Space_Type		Space_Type				
1	Sub_Floor_02	→	Space_Type		Space_Type				
2	Ground_Floor	→	Space_Type		Space_Type				
3	Floor_01	→	Space_Type		Space_Type				
4	Floor_02	→	Space_Type		Space_Type				
5	Floor_03	→	Space_Type		Space_Type				
6	Floor_04	→	Space_Type		Space_Type				
7	Floor_05	→	Space_Type		Space_Type				
8	Floor_06	→	Space_Type		Space_Type				
9	Floor_07	→	Space_Type		Space_Type				
10	Floor_08	→	Space_Type		Space_Type				
11	Floor_09	→	Space_Type		Space_Type				
12	Floor_10	→	Space_Type		Space_Type				

Simple feature class Main_Substation_Feeder									
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale	Length	Geometry Point Contains M values: Yes Contains Z values: Yes	
OBJECTID	Object ID								
SHAPE	Geometry	Yes							
Unique_ID	String	Yes					50		
Job_ID	Long integer	Yes			0				
Label	String	Yes					50		
Circuit_Breaker_Type	Long integer	Yes		Circuit_Breaker_Type	0				
Circuit_Breaker_Make	String	Yes					50		
Current_Rating	String	Yes					50		
Fault_Level	String	Yes					50		
Voltage_Rating	String	Yes					50		

Simple feature class Distribution_Station_Feeder									
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale	Length	Geometry Point Contains M values: Yes Contains Z values: Yes	
OBJECTID	Object ID								
SHAPE	Geometry	Yes							
Unique_ID	String	Yes					50		
Job_ID	Long integer	Yes			0				
Type	Long integer	Yes	0		0				
Label	String	Yes					50		
Circuit_Breaker_Type	Long integer	Yes		Circuit_Breaker_Type	0				
Circuit_Breaker_Make	String	Yes					50		
Current_Rating	String	Yes					50		
Fault_Level	String	Yes					50		
Voltage_Rating	String	Yes					50		

Subtypes of Distribution_Station_Feeder									
Subtype field: Type									
Default subtype: 0									
List of defined default values and domains for subtypes in this class									
Subtype Code	Subtype Description		Field name	Default value	Domain				
0	Sub_Station	→	Circuit_Breaker_Type		Circuit_Breaker_Type				
1	Mini_Sub_Station	→	Circuit_Breaker_Type		Circuit_Breaker_Type				

Simple feature class Distribution_Station_Transformer									
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale	Length	Geometry Point Contains M values: Yes Contains Z values: Yes	
OBJECTID	Object ID								
SHAPE	Geometry	Yes							
Unique_ID	String	Yes					50		
Job_ID	Long integer	Yes			0				
Label	String	Yes					50		
Primary_Voltage	Long integer	Yes			0				
Secondary_Voltage	Long integer	Yes			0				
Rating_kVA	Long integer	Yes			0				
Vector_Group	String	Yes					50		
Impedance	String	Yes					50		
Make	String	Yes					50		
Year_of_Manufacture	Date	Yes			0	0	8		
Oil_Level	String	Yes					50		
Silica_Gel	String	Yes					50		

Simple feature class Cables									
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale	Length	Geometry Polyline Contains M values: Yes Contains Z values: Yes	
OBJECTID	Object ID								
SHAPE	Geometry	Yes							
Unique_ID	String	Yes					50		
Job_ID	Long integer	Yes			0				
Ring_Feeder	Long integer	Yes		Ring_Feeder	0				
Sup_DB	Long integer	Yes			0				
Sup_MS_Feeder	Long integer	Yes			0				
Sup_DS_Feeder	Long integer	Yes			0				
Sup_DS_Transformer	Long integer	Yes			0				
Cable_Material	Long integer	Yes		Cable_Materials	0				
Cable_Size	Long integer	Yes		Cable_Sizes	0				
Cable_Composition	Long integer	Yes		Cable_Composition	0				
Outside_Diameter	String	Yes					50		
Termination	String	Yes					50		
SHAPE_Length	Double	Yes			0	0			
Cable_Position	Long integer	Yes	0		0				

Subtypes of Cables					
Subtype field		Cable_Position			
Default subtype		0			
List of defined default values and domains for subtypes in this class					
Subtype Code	Subtype Description		Field name	Default value	Domain
0	Sub_Floor_01	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
1	Sub_Floor_02	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
2	Ground_Floor	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
3	Floor_01	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
4	Floor_02	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
5	Floor_03	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
6	Floor_04	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
7	Floor_05	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
8	Floor_06	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
9	Floor_07	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
10	Floor_08	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
11	Floor_09	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
12	Floor_10	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition
13	Outside	➡	Ring_Feeder Cable_Material Cable_Size Cable_Composition		Ring_Feeder Cable_Materials Cable_Sizes Cable_Composition

Appendix C

Appendix C: PUK Geodatabase Metadata

Appendix D: PUK Geodatabase Metadata									
Title	Abstract	Digitizing method	Data source	Attributes	Coordinate system	Spatial representation	Date created	Created by	Scale
PUK_Zones	This feature class illustrates the different alphabetical campus zones.	The feature class was digitized using an image and CAD file representing the campus zones.	Potchefstroom campus: Technical services department.	Object_ID, Unique_ID, Number_of_buildings, Shape, Shape_length, Shape_area.	Type: Projected Datum: WGS_84 Projection: WGS_1948_UTM_35_S	Vector: Polygon	May 2011	D.A. Maree	1 : 100
PUK_Buildings	This feature class represents all the buildings in the Potchefstroom campus.	The feature class was created using the CAD data representing the layouts of building E4 and E6.	Potchefstroom campus: Technical services department.	Object_ID, Unique_ID, Zone_ID, Name_of_building, Faculty, Department, Number_of_floors, Shape, Shape_lenght, Shape_area.	Type: Projected Datum: WGS_84 Projection: WGS_1948_UTM_35_S	Vector: Polygon	May 2011	D.A. Maree	1 : 100
PUK_Rooms	The feature class represents all the rooms on the different levels of each building by means of subtypes.	The features were digitized from georeferenced CAD files representing the different rooms on each level inside the buildings.	Potchefstroom campus: Technical services department.	Object_ID, Unique_ID, Building_ID, Space_Type, Owner_ID, Capacity, Floor, Shape, Shape_Length, Shape_Area.	Type: Projected Datum: WGS_84 Projection: WGS_1948_UTM_35_S	Vector: Polygon	May 2011	D.A. Maree	1 : 100
MS_Feeder	This feature class represents the main source of electricity for the campus. It is digitized as a point feature attached to the cables distributing electricity to the various DS_Feeder.	The location for the MS_Feeder was determined through an interview with the electrical manager and created as a point feature.	Potchefstroom campus: Technical services department.	Object_ID, Shape, Unique_ID, Job_ID, Label, Circuit_Breaker_Type, Circuit_Breaker_Make, Current_Rating, Fault_Level, Voltage_Rating.	Type: Projected Datum: WGS_84 Projection: WGS_1948_UTM_35_S	Vector: Point	April 2011	D.A. Maree	1 : 100

Appendix D: PUK Geodatabase Metadata (Continued)

Title	Abstract	Digitizing method	Data source	Attributes	Coordinate system	Spatial representation	Date created	Created by	Scale
DS_Feeder	The DS_Feeder receives electrical current from the MS_Feeder and use a transformer to distribute electricity to connected buildings.	The locations of the participating DS_Feeder was determined by means of a campus infrastructure CAD drawing. This feature class is digitized as a point feature.	Potchefstroom campus: Technical services department.	Object_ID, Shape, Unique_ID, Job_ID, Type, Label, Circuit_Breaker_Type, Circuit_Breaker_Make, Current_Rating, Fault_Level, Voltage_Rating.	Type: Projected Datum: WGS_84 Projection: WGS_1948_UTM_35_S	Vector: Point	April 2011	D.A. Maree	1 : 100
DS_Transformer	The DS_Transformers are located inside the DS_Feeder. It is digitized as a separate feature because of its difference in attributes. The DS_Transformer converts the electrical current to a lower voltage before it reaches the distribution boards inside the buildings.	The locations of the DS_Transformers is the same as the DS_Feeder. This feature class is digitized as a point feature.	Potchefstroom campus: Technical services department.	Object_ID, Shape, Unique_ID, Job_ID, Label, Primary_Voltage, Secondary_Voltage, Rating_kVA, Vector_Group, Impedance, Make, Year_Of_Manufacture, Oil_Level, Silica_Gel.	Type: Projected Datum: WGS_84 Projection: WGS_1948_UTM_35_S	Vector: Point	April 2011	D.A. Maree	1 : 100
Distribution_Board	The Distribution Boards are located inside different buildings. The boards receive electrical current from the transformers outside and distribute it to all the utility endpoints.	The distribution boards were captured using the CAD drawings provided. The location of each board was determined and the feature class was digitized as point features.	Potchefstroom campus: Technical services department.	Object_ID, Shape, Unique_ID, Job_ID, Room_ID, kA_Rating, Phase_Rotation, Phase, DB_Location, Board_Type.	Type: Projected Datum: WGS_84 Projection: WGS_1948_UTM_35_S	Vector: Point	July 2011	D.A. Maree	1 : 100

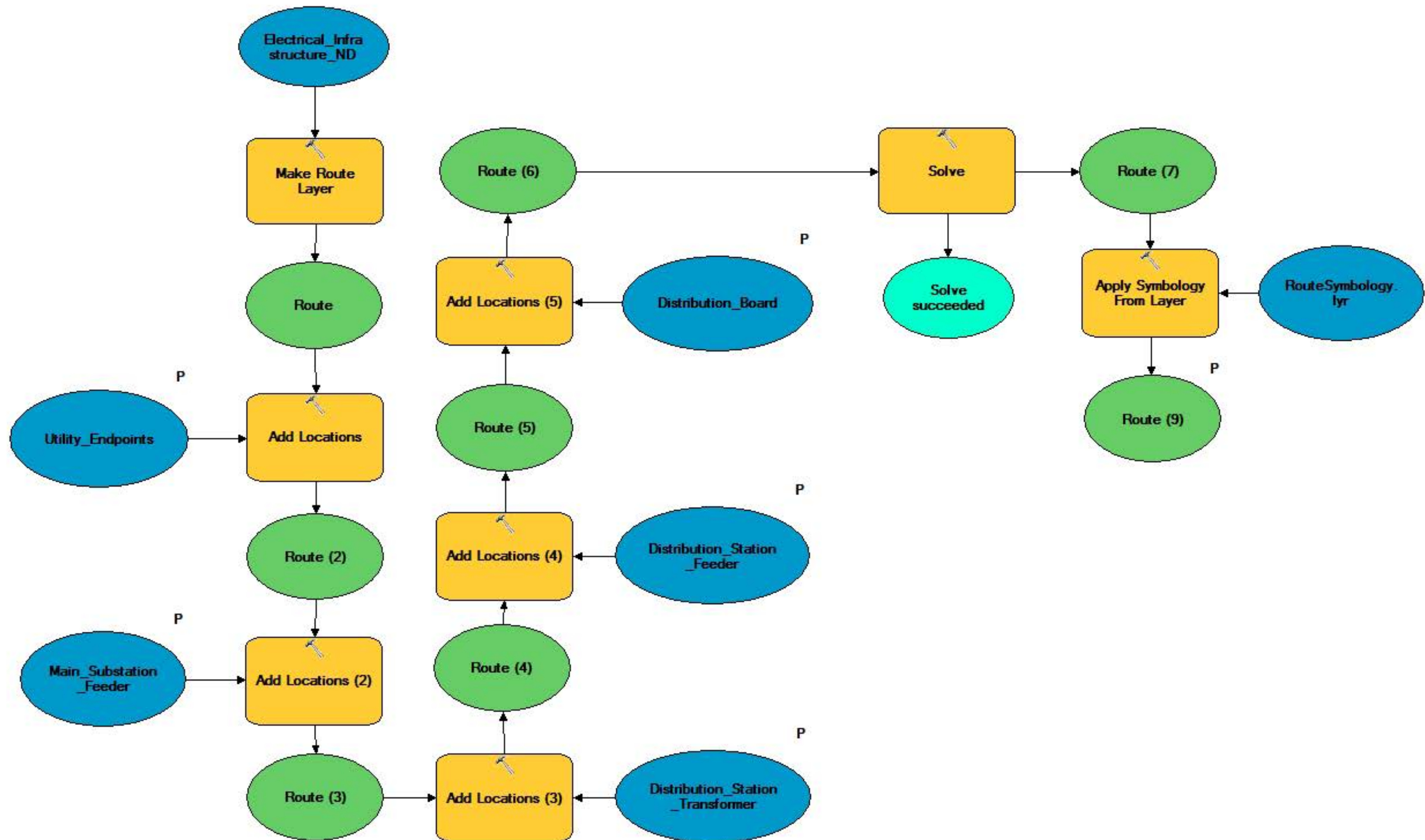
Appendix D: PUK Geodatabase Metadata (Continued)									
Title	Abstract	Digitizing method	Data source	Attributes	Coordinate system	Spatial representation	Date created	Created by	Scale
Cables	The cables feature class connects all the point features forming the electrical network on micro and macro level on the Potchefstroom campus in 3D. Subtypes are used to distinguish between cable locations on different levels.	The locations of the various cables running outside and inside buildings were unknown. The cable locations had to be assumed. This feature class is digitized as line features.	Potchefstroom campus: Technical services department.	Object_ID, Shape, Unique_ID, Job_ID, Ring_Feeder, Sup_DB, Sup_MS_Feeder, Sup_DS_Feeder, Sup_DS_Transformer, Cable_Material, Cable_Size, Cable_Composition, Outside_Diameter, Termination, Shape_Length, Cable_Position.	Type: Projected Datum: WGS_84 Projection: WGS_1948_UTM_35_S	Vector: Line	July 2011	D.A. Maree	1 : 100
Utility_Endpoints	The feature class represent the different plugs inside the rooms on the different levels of the two buildings. Two types of plugs are distinguished.	The plug locations were determined through the CAD drawings representing the electrical utilities inside the buildings. The utility endpoints are digitized as point features.	Potchefstroom campus: Technical services department.	Object_ID, Shape, Unique_ID, Job_ID, Cable_ID, Room_ID, Type, Phase, Level.	Type: Projected Datum: WGS_84 Projection: WGS_1948_UTM_35_S	Vector: Point	July 2011	D.A. Maree	1 : 100
Owner_Table	This information table contains information regarding occupants of offices inside buildings.	Attribute information regarding the table was obtained by the building manager and administrative personnel responsible for the two buildings. The information was listed inside the Owner_Table. This table was created in ArcCatalog10.	Potchefstroom campus: Building managers and administrative personnel.	Object_ID, Owner_ID, Owner_Name, Tel_Number, E_mail, Department.	N/A	Table	July 2011	D.A. Maree	N/A

Appendix D: PUK Geodatabase Metadata (Continued)

Title	Abstract	Digitizing method	Data source	Attributes	Coordinate system	Spatial representation	Date created	Created by	Scale
Maintenance_Register	This information table contains information about the maintenance done on each electrical feature.	No records were kept about the maintenance done on electrical features. A fictional maintenance record was created for the electrical utilities to demonstrate the abilities of such a register. This table was created in ArcCatalog10.	No data available.	Object_ID, Contractor_ID, Install_date, Utility_Component, Last_updated.	N/A	Table	July 2011	D.A. Maree	N/A
List_of_Contractors	This information table contains information about the electrical contractors who has done maintenance on the utilities. The table contains general and contact information.	No records were kept for the different contractor personnel who previously worked on electrical utilities. A fictional list of contractors was created to demonstrate the abilities of such a table.	No data available.	Object_ID, Contractor_Name, Occupation, Contractor_Tel_nr, Email, Company, Campus, Fax_nr.	N/A	Table	July 2011	D.A. Maree	N/A
Campus_Fishnet	The extent of the fishnet created to locate electrical features outside the buildings is approximately the extent of the Potchefstroom campus. The cell size of the fishnet is 1m by 1m.	The fishnet was created using the Create Fishnet tool in ArcToolbox.	ArcCatalog10.	OID, Shape, Shape_Length	Type: Projected Datum: WGS_84 Projection: WGS_1948_UTM_35_S	Vector: Line	July 2011	D.A. Maree	N/A
Quick Bird 2008 Satellite Image	This satellite image represents the campus of the NWU university. This referenced image was used as base data on which features was digitized according to a predefined coordinate system.	The obtained image was imported into the PUK geodatabase.	QuickBird. 2008. Satellite Application Center. CSIR: Pretoria.	N/A	Type: Projected Datum: WGS_84 Projection: WGS_1948_UTM_35_S	Satellite Image	2008	CSIR Pretoria	Scale factor: 0.6m by 0.6m

Appendix D

Appendix D
Model diagram for shortest route analysis



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