How to Estimate the Cost of Landscape Planting and Irrigation for a Typical University Campus Building

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TABLE OF CONTENTS

Section 1 Introduction

The purpose of this technical paper is to provide the reader with the information required to understand the factors involved in performing a quantity take-off and estimate for the landscape planting and irrigation scope of work of a University campus building project. Landscape planting and irrigation provide an integral role for the character and overall architectural appearance of university campus projects. In addition to this, landscaping provides a practical purpose for these projects which includes cost savings in site finishes, natural drainage, storm water pollution prevention, and solar heat reduction, just to name a few benefits. This paper will explore the fundamental elements of landscaping and irrigation for a university campus project and discuss the process for creating a cost estimate based on the quantity take-offs, which include the labor, material, equipment, indirect costs, and other influential factors that affect pricing for a this scope of work.

Main CSI (Construction Specifications Institute 2004 Master Format) Division

Division 31 Earthwork

Division 32 Exterior Improvements

Main CSI (Construction Specifications Institute 2004 Master Format) Subdivision

Division 31 23 00 Excavation and Fill

Division 32 84 00 Planting Irrigation

Division 32 90 00 Planting

Division 32 94 00 Planting Accessories

Brief Description

In order to properly estimate landscaping and irrigation, one must have a thorough understanding of the scope of work being estimated as it relates to the project as a whole. It is important to consider the following factors: who is the owner / client, where is the project located, what is the quantity of work being performed, what is the availability of labor and materials, and what additional factors are included such as taxes, insurance, bonds, and prevailing wages. There are other factors that influence the landscape and irrigation of a university project as well, including green building and sustainability. Some examples of sustainability in landscaping and irrigation include reduced water usage for planting and the use of reclaimed or "gray" water for irrigation. The intent of this paper is provide the reader with the following: 1. Ability to recognize which items are included in the landscape and irrigation scope of work, 2. Evaluate different methods for performing accurate quantifications for labor/material/equipment known as "take-offs", 3. Determine which specific factors affect costs and pricing, and 4. Understand how to test the estimate for quality control and accuracy.

Section 2 Types and Methods of Measurement

Performing quantity take-offs for a landscape and irrigation project for a university requires a combination of many different units including the following: square footage, quantity counts, linear measurements, and cubic footage take-offs. In addition to the various units that are used in quantity take-offs for a landscaping project, there are various methods for gathering these quantities, including manual take-offs from a hard copy set of documents or digital take-offs performed electronically utilizing on-screen estimating software. Whether the quantity take-off

is conducted manually or digitally is completely up to the estimator. The main objective of the take-offs is to extract and quantify the information from the project documents in a logical sequence that is both comprehensive and accurate.

The estimating process begins with the initial efforts of collecting all of the relevant information. During this phase, the estimator gathers all of the facts that are available from the project documents, owner, and consultants. This includes the landscaping design plans, specifications, any addenda issued by the design architect, a site visit to the project location if feasible, and any additional information deemed necessary to evaluate the comprehensive scope of work. Once the project information has been collected and reviewed, the estimator determines if there is sufficient information to provide a cost estimate for the work. If there is any question or doubt regarding the scope of work, the estimator may submit a request for information to the design team to obtain the clarifications required to properly understand the work and be able to quantify it. Keep in mind, however, when providing a conceptual estimate the estimator does not have all of the information available and the documents are typically preliminary in design. In this example, the estimator relies on experience and judgment to provide assumptions to account for the missing details and information and quantifies the scope of work on more of a global scale. The assumptions are then clarified within the body of the estimate so that the scope of work is clearly defined and the key components can be budgeted.

After the project information has been collected, and the estimator feels comfortable with the quality and quantity of the information available, the quantity take-off phase begins. As previously discussed, the units most utilized used in estimating landscaping and irrigation

include square footage, as used for sod and covered areas, quantity counts for items such as trees, linear quantities in feet for irrigation piping, and cubic yardage for items including earthwork and soil. The quantity take-offs can be performed either manually or digitally, and should be extracted in a logical sequence to ensure that all of the key components are captured and none of the items are taken off multiple times or "doubled-up".

The estimator takes off landscaping and irrigation quantities in a logical sequence to ensure that the entire scope of work is accounted for. There are several ways of accomplishing this. One method the estimator uses to quantify materials in a logical sequence is to take off the work in the order of the anticipated installation. This process requires the estimator to consider the entire installation process from beginning to end. The estimator may also utilize the grouping method which identifies the materials by their specific processes. For example, the irrigation work would be taken off followed by the planting work. For purposes of this paper, both of these methods will be utilized to create the most efficient process for accounting for the items within the landscape and irrigation estimate.

The take-off for landscape planting and irrigation begins with control quantities. A control quantity is a measurement used to reference the work from a global perspective and as a means for double-checking the quantities. For example, if the overall site is 107,000 gross square feet and the take-off for landscaping area accounts for 35,000 square feet, it can be inferred that the landscaping potion covers roughly 33% of the site. This number can be used in several ways. One way that the control quantity is used is to perform a cost per square analysis of the landscaping area. By utilizing historical cost data, comparing the scope of work to similar projects, the estimator can predict what the cost per square foot range may be. This is a useful

tool for crosschecking the accuracy of the take-off and pricing against previous projects. The control quantity can also be used to confirm the total landscaping area. For example, if the finished landscaping consists of 20,000 square feet of hydroseed and 15,000 square feet of sod, the total would be 35,000 square feet which equals the control quantity taken off for the planted area. If the two numbers did not equal the control quantity, this would be an indication that there may be an error in the take-offs.

Once the control quantity(s) have been established, the estimator begins the first material take-off in the logical sequence which includes evaluating the soil conditions. The rough grading and mass excavation of the site is typically completed by the civil contractor, leaving the finish grading and soil improvements to the landscape contractor. The landscape subcontractor is often responsible for the topsoil placement and soil preparation for the installation of the planting areas. Depending on the specification requirements and availability of suitable materials, the topsoil is typically either imported from off-site or recovered from the excavation stripping created by the earthwork contractor on site. This quantity will typically be taken off in cubic yards, similarly how it is purchased from the material supplier. This calculation can be accomplished by taking the coverage area (in square feet) and multiplying by the depth of the soil (in feet or inches), and then dividing the product of those numbers by 27 to convert the cubic feet into cubic yards. Once the topsoil has been placed, there may be some finish grading and soil amendment applications required. This quantity is taken off in either square feet or cubic yards, depending on the unit used in the estimator's historical cost data.

Once the soil preparation is accounted for, the irrigation piping and trenching take-off can begin. Irrigation piping is represented on the plans by solid black lines and corresponding pipe

yards, or cubic feet. There isn't a specific way to account for the item as long as the unit cost associated with the quantity makes sense.

Section 3 Specific Factors to Consider Affecting Takeoff and Pricing

Small Quantities versus Large Quantities

One important factor to consider when applying pricing to the quantities taken off is whether or not the quantity is a large number or a small number. The very classification as a large or small quantity is ambiguous by its own merit; however, this number has a direct correlation to the number used as the basis for the historical cost data. For example, if the pricing used for the historical cost data is based on 100,000 square feet of landscaping and the current project square feet only covers 35,000 square feet, there will need to be some price adjustment made. The reason for this is that there are economies of scale in larger projects and quantities, where materials can typically be bought in bulk for cheaper than the smaller projects. In addition to this, greater efficiencies in production can be achieved on larger scale projects, as the crew has more time to enhance and increase work flow by achieving efficiencies. On the smaller projects, the work crews have less of an opportunity to create an efficient work flow because their construction duration is much shorter.

Geographic Location

Another factor that affects the pricing of quantity take-offs is the geographical location of the project. This factor can affect the price of labor, taxes and freight charges on materials, as well as indirect costs such as special insurances for hazards and builder's risk. The geography of the project can also affect the planting irrigation where in some areas of the country there is a lot

of precipitation versus other areas where there is extremely limited rain. It is important for the estimator to consider the location of the project and the impacts of that location on the estimate.

Seasonal Effects on Pricing

The time of year can also play a role in influencing costs in the estimate. Landscape planting and irrigation is often completed at the end of the project, which means the estimator must know what the project duration is and how the landscaping scope of work fits into the project schedule. The project schedule affects the planning for labor, anticipated material price escalation, as well as weather that could potentially delay or interfere with the installation and placement of landscape planting. For a university project, it is also very important to consider the Owner's school schedule and any impacts that the construction process may have on students and continuing operations.

Sustainability in Landscaping and Irrigation

A growing trend in many university projects is the application of sustainability and more specifically, LEED principles in the design of landscaping projects. LEED (Leadership in Energy & Environmental Design) is a rating system and certification program created by the US Green Building Council which recognizes projects for their excellence in sustainability and utilization of environmentally friendly materials and practices. Some of the key influences of LEED on university landscaping projects include the use of recycled water from either city supply or onsite water collection systems. Another example of LEED on water reduction is the use of smart irrigation controllers such as weather stations, which similar to a thermostat, control the

water supply as opposed to the standard controller which works on a particular schedule. The final impact of LEED on university landscaping projects to be discussed is the acquisition of LEED points themselves. Certain LEED credits will require using regionally available materials, additional management and resources to obtain points, as well as close coordination with other trades whose scopes of work are integral to the landscaping and irrigation. All of these factors will affect the estimator's pricing, so it is important for the estimator to understand sustainability and how the budget is affected by LEED principles. **(LEED Web Site)**

Section 4 Overview of Labor, Material, Equipment, Indirect Costs, and Approach to Mark-ups

Labor is the work put in place on the project and is calculated in man hours. For a landscaping project, the work is almost always completed in the field as there is minimal, if any, fabrication required. Three elements that influence the pricing for labor are the type of crew, the production rate for the specified crew, and the pay structure. A crew consists of specialized and non-specialized workers who perform the work in the field. A typical landscape crew can include laborers, skilled workers, and light equipment operators. Additional classifications of workers may be required depending on the complexity of the project. Each task may require a different type of crew. For example, irrigation may require a crew of two skilled workers, whereas, trenching may require a laborer and light equipment operator to dig the trench. Each specific task will require a certain crew, and that crew will have a combined crew rate that is based on an hourly or daily rate. When applying the specified crew rate to the quantity and unit of measurement, a production rate is used to indicate how much or how many of a specified task is accomplished by the crew in a specified time. For example, a trenching crew may have a production rate of 30 linear feet of trench per hour. The production rate would therefore be

0.500 or 1 linear foot per two minutes. The pay structure also affects labor pricing. Many university projects, especially those funded with public money, will require prevailing wages that are typically higher than wages from open shop contractors. The prevailing wages include the set labor rate along with the fringe benefits that are required for the work put in place for a specified location.

Material costs influence the estimate pricing in a number of ways. In addition to the hard costs that are associated with the materials, some of additional factors include availability, freight charges, especially if not local to the project, utilization of native versus non-native plants, as well as local and state sales or use taxes. Another factor that often affects the material costs is escalation in pricing. Landscape and irrigation prices, similar to those in any industry are affected by the government's economy including inflation and other political occurrences beyond the control of foresight. If a project is not going to begin in the near future, the estimator will add escalation costs in addition to the current costs to account for anticipated material price increases.

Equipment costs are typically accounted for on an hourly rate. The greatest determinants of equipment costs include renting or owning the equipment and fuel. If renting the equipment, the estimator will have to account for the hourly cost, availability of the equipment, and all applicable taxes. If the company owns the equipment, there may be maintenance and upkeep charges that are billed into the company's own equipment charges. Fuel costs also impacts the equipment costs depending on the size and type of equipment used and price of fuel at the time of construction.

The indirect costs for a typical landscape project can include company overhead costs, specific insurances requirements such as general liability and worker's compensation, payment and performance bonds, and the contractors' fee. On a typical university project, specifically a publicly funded project, the insurance requirements are often specified. It is important for the estimator to pay particular attention to the front end documents and general conditions. The management team typically determines the extent of oversight required to accurately and efficiently supervise the project, while accounting for any overhead company costs that need to be spread on each project. Once the overhead charges have been determined, a fee will be added to the overall project which will be consistent with industry standards and the size, type and complexity of the project that is estimated.

Section 5 Special Risk Factors

Estimating landscaping and irrigation projects for a university campus building include a certain amount of risk, as is typical of any project. The greatest risks on these types of projects are the unknowns. While the estimator should make every attempt to gather adequate information to serve as the basis for the estimate there may be unforeseeable events. These occurrences can include project delays, unknown site conditions such as undocumented materials, availability of resources, etc. The estimator accounts for these events through proper planning, scheduling, and providing contingencies for unknowns.

Section 6 Ratios and Analysis- Tools Use to Test the Bid

Every project is unique and has its own specific requirements and challenges, however, the experienced estimator utilizes knowledge from previous projects and historical data to find

similarities and compare the projects. As discussed in the procedure for performing quantity take-offs for landscaping, the estimator uses control quantities as a sanity check against the quantities obtained. A control quantity can be created on the entire project site as well as the landscaping potion. If the ratio of landscaping to total site area appears to be too high or too low, its' possible that there is an error in the scale or the take-off itself. The control quantity can also be used by multiplying the landscape finished area by a unit cost per square foot based on historical data. The current cost of the estimated project should be consistent with the historical cost per square foot data with all irregular factors considered, accounted for, and with the required adjustments made.

Another tool that is equally as important as the control quantities is the quality and control process. Although the estimator has several modern tools at his disposal including on-screen take-offs, advanced estimating software, etc., the most important tool is the quality control process. This can be achieved through a number of means such as calculation checks applied to mathematical functions and proofreading of estimates by other individuals. Despite the estimator's general reputation of being accurate and precise with the numbers, the fact remains that all estimates are subject to human error, and a fresh set of eyes reviewing the final estimate is always preferred.

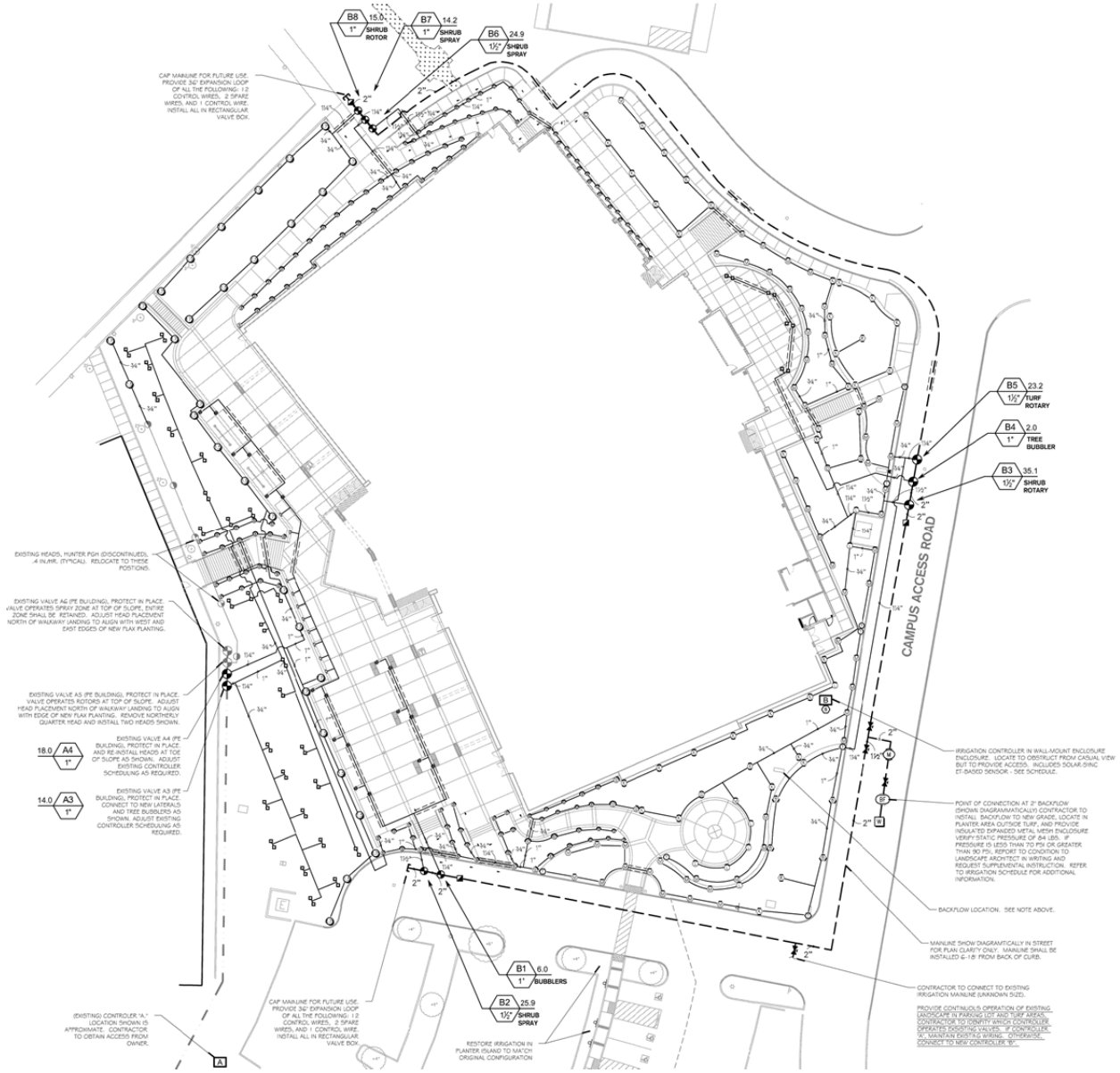
Section 7 Miscellaneous Other Pertinent Information

Landscaping and irrigation estimates for university projects require more than just quantity take-offs and the application of unit pricing. They require an overall understanding of the complete project and how the scope of work relates to the other trades as well. It is also helpful

to have an understanding of the client and knowledge of their expectations and specific requirements. By having a global perspective of the project the estimator ensures that the scope is inclusive of all the elements of the landscaping and irrigation package. The key to success for these types of estimates is gathering sufficient information, asking as many questions as may be necessary and using quality control to ensure that the finished product is accurate and complete.

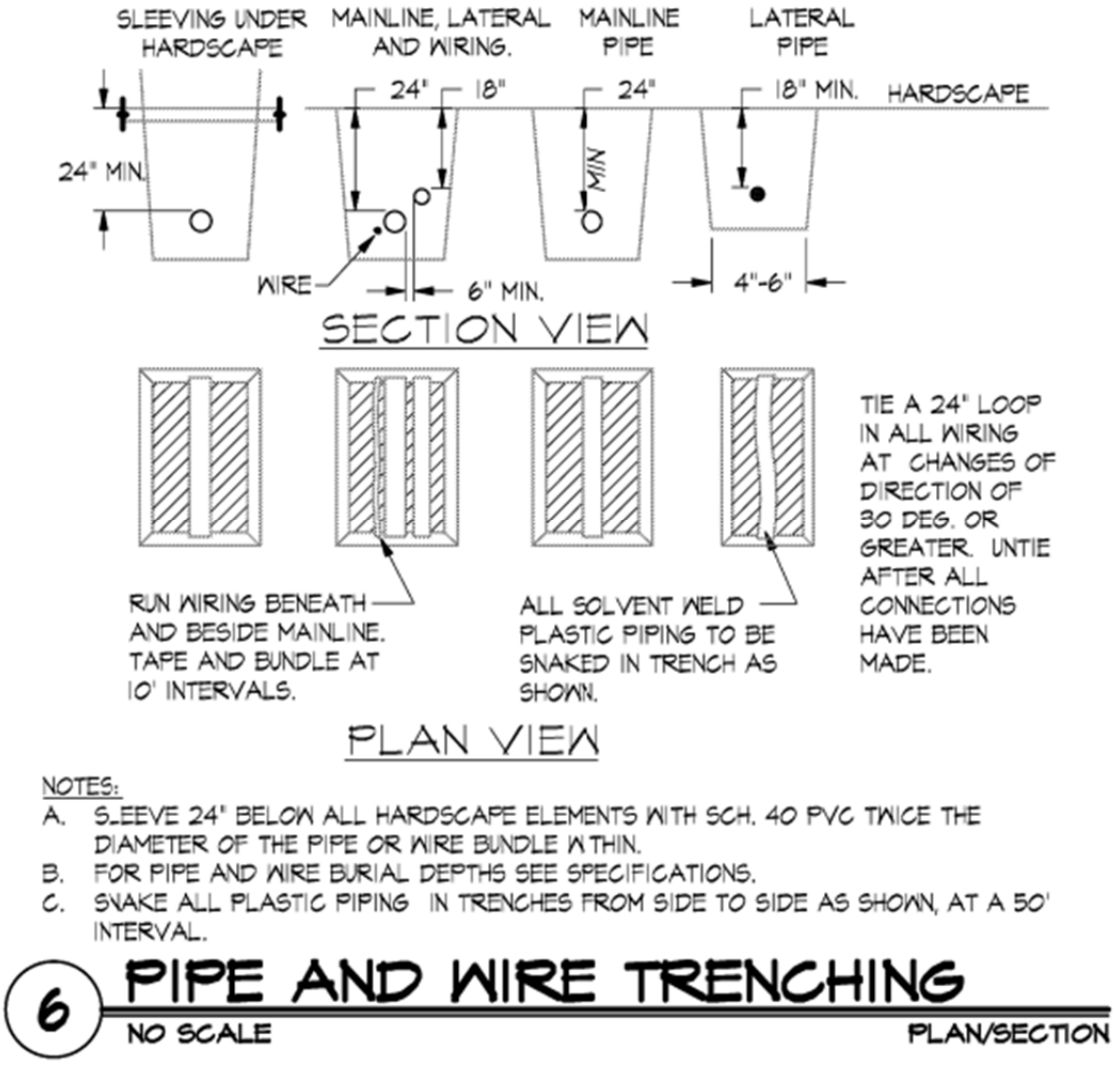
Section 8 Sample Sketch and Plans

Exhibit A- Landscaping Irrigation Plan



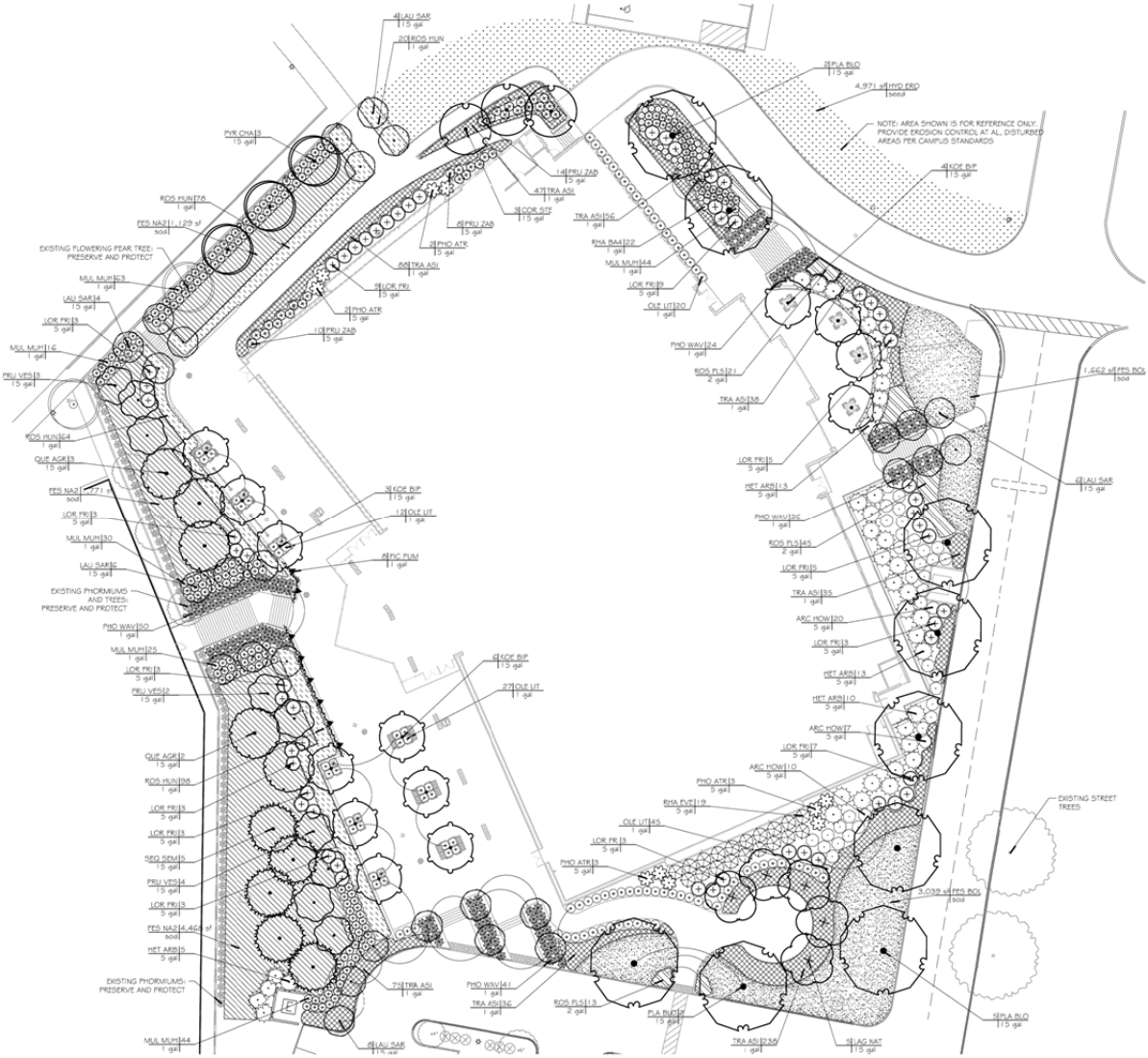
This plan represents a sample irrigation plan for a university campus building. The irrigation plan includes the point of connection(s) to the water domestic water supply line, the irrigation piping, and the sprinklers and other miscellaneous equipment locations and sizes.

Exhibit B- Landscaping Irrigation Details



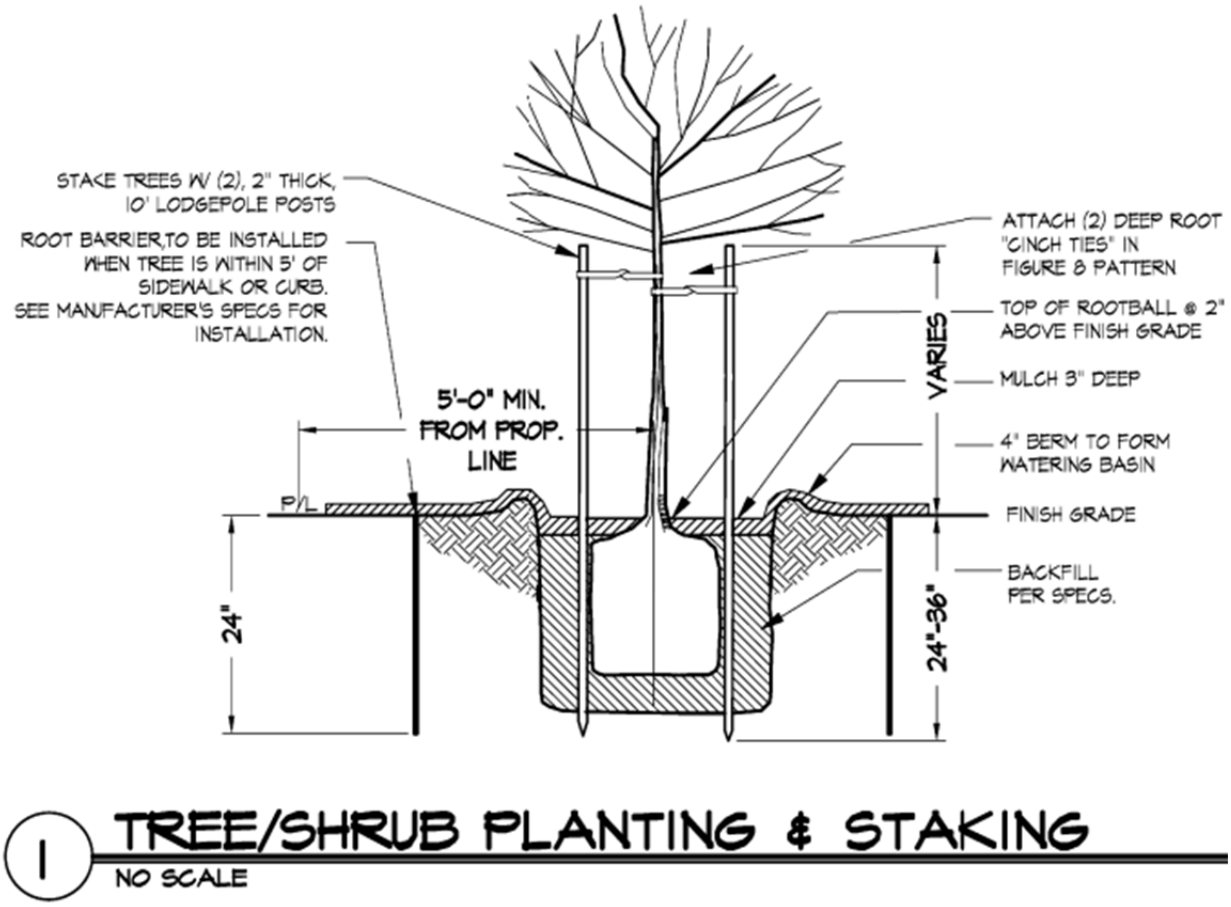
This sketch represents the typical pipe and trench detail for the irrigation piping. Additional information can be found within the project specifications or from the landscape architect as required to clarify the scope of work.

Exhibit C- Landscaping Planting Plan



This plan represents a sample landscape planting plan for a typical university building project. It includes the various plant types, locations, and quantities for take-off purposes. It typically includes trees, shrubs and groundcovers, and planting accessories such as header board locations.

Exhibit D- Landscaping Planting Details



This sketch represents a typical detail for tree planting, which includes staking, planting depth, mulch, and root barrier. It's important to know if there are any unusual planting circumstances that may require additional labor or other direct costs.

Exhibit E- Landscaping Planting and Irrigation Plans Utilizing On-Screen Take-offs

These sketches represent the digital take-offs performed by onscreen software for speed and accuracy.

Section 9 Sample Take-Off and Pricing Sheet

Control Quantities:

Gross Site Area	107,000 Square Feet
Building Footprint Area	45,000 Square Feet
Finished Site Area	(107,000 SF – 45,000 SF) = 62,000 SF
Gross Landscaping Covered Area	35,000 Feet or 56.45% of Finished Site Area

Quantity Take-offs:

Scope of Work (Complete Descriptions)	Quantity	Unit
Earthwork		
Import of topsoil per specification requirements	650	cy
Finish grade landscaping area; rough grading by civil contractor	35,000	sf
Soil preparation and amendments	35,000	sf
Trenching for Irrigation		
Excavation of trenches	290	cy
Backfill and compaction of trenches	200	cy
Off-haul spoils from trench excavation	70	cy
Irrigation		
Pipe sleeves, schedule 40	480	lf
Pipe, PVC, 2” main	860	lf
Pipe, PVC, 1 ½”	60	lf
Pipe, PVC, 1 ¼”	410	lf
Pipe, PVC, 1”	400	lf
Pipe, ¾”	4,450	lf
Connection to existing water main; stubbed out by civil contractor	4	ea
Cap end of pipe for future use, including valve box	2	ea
Control wiring	857	lf
Sprinklers		
Sprinkler head, Type 1	31	ea
Sprinkler head, Type 2	3	ea
Sprinkler head, Type 3	109	ea
Sprinkler head, Type 4	65	ea
Sprinkler head, Type 5	39	ea
Sprinkler head, Type 6	88	ea
Sprinkler head, Type 7	25	ea
Sprinkler head, Type 8	14	ea
Sprinkler head, Type 9	4	ea

Quantity Take-offs Continued:

Scope of Work (Complete Descriptions)	Quantity	Unit
Miscellaneous Irrigation		
Master valve, solid brass, electric	1	ea
Irrigation valve	8	ea
Bronze gate shut off valve	4	ea
Backflow preventer	1	ea
Water meter, 2”	1	ea
Controller, wall mounted, 12 stations, w/ metal cabinet	1	ea
Wireless solar, rain freeze sensor, w/ outdoor interface	1	ea
Adjust existing controller to new grade	2	ea
Subcontractor to perform static and dynamic test	1	ea
Landscape Planting		
Trees, 15 gallon, various species	80	ea
Vines, 1 gallon	8	ea
Shrubs, 5 gallon, various species	198	ea
Shrubs, 1 gallon, various species	489	ea
Sod	12,135	ea
Hydroseed	4,971	ea
Roses, 2 gallon, at 36” on center	90	ea
Rosemary, 1 gallon, at 36” on center	320	ea
Asian Jasmine, 1 gallon, at 30” on center	760	ea
Miscellaneous Landscaping Items		
Root barrier, per L3.0 plan and specifications	100	lf
Redwood header board, per detail 9 on sheet L1.1	288	lf
Bark mulch, 3” depth, per sheet note 10 on sheet L3.1	170	cy
Landscape Maintenance		
Landscape maintenance, 90 days beyond initial installation, per specs.	242	hours

Labor Costs:

			LABOR COSTS				
Scope of Work (Partial Descriptions)	Quantity	Unit	Production Rate (labor hours per unit)	Productivity Factor	Total Hours Labor	Crew Rate	Total Labor Cost
Import of topsoil	650	cy	0.027	1.00	17.55	$66.00	$1,158.30
Finish grade landscaping	35,000	sf	0.001	1.25	43.75	$66.00	$2,887.50
Soil prep & amendments	35,000	sf	0.001	1.25	24.31	$66.00	$1,604.17
Excavation of trenches	290	cy	0.250	1.00	72.50	$66.00	$4,785.00
Backfill / compact trench	200	cy	0.150	1.00	30.00	$66.00	$1,980.00
Haul excess spoils	70	cy	0.100	1.00	7.00	$66.00	$462.00
Pipe sleeves, schedule 40	480	lf	0.050	1.00	24.00	$66.00	$1,584.00

Pipe, PVC, 2” main	860	lf	0.015	1.00	12.90	$66.00	$851.40
Pipe, PVC, 1 ½”	60	lf	0.015	1.00	0.90	$66.00	$59.40
Pipe, PVC, 1 ¼”	410	lf	0.015	1.00	6.15	$66.00	$405.90
Pipe, PVC, 1”	400	lf	0.015	1.00	6.00	$66.00	$396.00
Pipe, ¾”	4,450	lf	0.015	1.00	66.75	$66.00	$4,405.50
Connect to existing pipe	4	ea	1.000	1.00	4.00	$66.00	$264.00
Cap end of pipe	2	ea	1.000	1.00	2.00	$66.00	$132.00
Control wiring	857	lf	0.015	1.00	12.86	$66.00	$848.43
Sprinkler head, Type 1	31	ea	0.500	1.00	15.50	$66.00	$1,023.00
Sprinkler head, Type 2	3	ea	0.500	1.00	1.50	$66.00	$99.00
Sprinkler head, Type 3	109	ea	0.500	1.00	54.50	$66.00	$3,597.00
Sprinkler head, Type 4	65	ea	0.500	1.00	32.50	$66.00	$2,45.00
Sprinkler head, Type 5	39	ea	0.500	1.00	19.50	$66.00	$1,287.00
Sprinkler head, Type 6	88	ea	0.500	1.00	44.00	$66.00	$2,904.00
Sprinkler head, Type 7	25	ea	0.500	1.00	12.50	$66.00	$825.00
Sprinkler head, Type 8	14	ea	0.500	1.00	7.00	$66.00	$462.00
Sprinkler head, Type 9	4	ea	0.500	1.00	2.00	$66.00	$132.00
Master valve, solid brass	1	ea	1.000	1.00	0.50	$66.00	$33.00
Irrigation valve	8	ea	1.000	1.00	4.00	$66.00	$264.00
Bronze gate shut off valve	4	ea	1.000	1.00	2.00	$66.00	$132.00
Backflow preventer	1	ea	1.000	1.00	0.50	$66.00	$33.00
Water meter, 2”	1	ea	1.000	1.00	1.00	$66.00	$66.00
Controller, wall mounted	1	ea	1.000	1.00	1.00	$66.00	$66.00
Rain freeze sensor	1	ea	1.000	1.00	0.50	$66.00	$33.00
Adjust existing controller	2	ea	1.000	1.00	2.00	$66.00	$132.00
Static and dynamic test	1	ea	2.000	1.00	2.00	$66.00	$132.00
Trees, 15 gallon, various	80	ea	1.000	1.00	80.00	$58.40	$4,672.00
Vines, 1 gallon	8	ea	0.500	1.00	4.00	$58.40	$233.60
Shrubs, 5 gallon	198	ea	0.250	1.00	49.50	$58.40	$2,890.80
Shrubs, 1 gallon	489	ea	0.250	1.00	122.25	$58.40	$7,139.40
Sod	12,135	sf	0.003	1.25	37.92	$58.40	$2,214.64
Hydroseed	4,971	sf	0.001	1.00	4.37	$58.40	$255.47
Roses, 2 gallon	90	ea	0.150	1.00	13.50	$58.40	$788.40
Rosemary, 1 gallon	320	ea	0.150	1.00	48.00	$58.40	$2,803.20
Asian Jasmine, 1 gallon	760	ea	0.150	1.00	114.00	$58.40	$6,657.60
Root barrier	100	lf	0.040	1.00	4.00	$58.40	$233.60
Redwood header board	288	lf	0.048	1.00	13.82	$58.40	$807.32
Bark mulch, 3”	170	cy	0.100	1.00	17.00	$58.40	$992.80
Landscape maintenance	242	hrs	0.750	1.00	90.74	$58.40	$5,299.36
Subtotal Labor Costs							**$70,176.79**

Material Costs:

			MATERIAL COSTS	
Scope of Work (Partial Descriptions)	Quantity	Unit	Material Unit Cost	Total Material Cost
Import of topsoil	650	cy	$32.25	$20,962.50
Pipe sleeves, schedule 40	480	lf	$1.00	$480.00
Pipe, PVC, 2" main	860	lf	$0.72	$618.21
Pipe, PVC, 1 ½"	60	lf	$0.55	$33.18
Pipe, PVC, 1 ¼"	410	lf	$0.46	$188.93
Pipe, PVC, 1"	400	lf	$0.38	$153.60
Pipe, ¾"	4,450	lf	$0.32	$1,424.00
Connect to existing pipe	4	ea	$100.00	$400.00
Cap end of pipe	2	ea	$50.00	$100.00
Control wiring	857	lf	$1.00	$857.00
Sprinkler head, Type 1	31	ea	$30.00	$930.00
Sprinkler head, Type 2	3	ea	$70.00	$210.00
Sprinkler head, Type 3	109	ea	$10.00	$1,090.00
Sprinkler head, Type 4	65	ea	$15.00	$975.00
Sprinkler head, Type 5	39	ea	$15.00	$585.00
Sprinkler head, Type 6	88	ea	$15.00	$1,320.00
Sprinkler head, Type 7	25	ea	$10.00	$250.00
Sprinkler head, Type 8	14	ea	$15.00	$210.00
Sprinkler head, Type 9	4	ea	$15.00	$60.00
Master valve, solid brass	1	ea	$450.00	$450.00
Irrigation valve	8	ea	$100.00	$800.00
Bronze gate shut off valve	4	ea	$60.00	$240.00
Backflow preventer	1	ea	$700.00	$700.00
Water meter, 2"	1	ea	$650.00	$650.00
Controller, wall mounted	1	ea	$500.00	$500.00
Rain freeze sensor	1	ea	$137.50	$137.50
Trees, 15 gallon, various species	80	ea	$80.00	$6,400.00
Vines, 1 gallon	8	ea	$20.00	$160.00
Shrubs, 5 gallon	198	ea	$25.00	$4,950.00
Shrubs, 1 gallon	489	ea	$15.00	$7,335.00
Sod	12,135	sf	$0.35	$4,247.50
Hydroseed	4,971	sf	$0.10	$497.10
Roses, 2 gallon	90	ea	$10.00	$900.00
Rosemary, 1 gallon	320	ea	$8.00	$2,560.00
Asian Jasmine, 1 gallon	760	ea	$8.00	$6,080.00
Root barrier	100	lf	$15.00	$1,500.00
Redwood header board	288	lf	$4.00	$1,152.00
Bark mulch, 3"	170	cy	$15.00	$2,550.00
Subtotal Material Costs				**$72,656.26**

*Note: Material Unit Costs includes sales tax and freight charges as applicable.

Equipment Costs:

			EQUIPMENT COSTS			
Scope of Work (Partial Descriptions)	Quantity	Unit	Total Hours	Total Days	Daily rate	Total Equipment Cost
Import and spread topsoil	650	cy	17.55	3.00	$500.00	$1,500.00
Finish landscape grading	35,000	sf	43.75	6.00	$500.00	$3,000.00
Soil preparation	35,000	sf	24.31	4.00	$500.00	$2,000.00
Excavate trenches	290	cy	72.50	10.00	$400.00	$4,000.00
Backfill and compact trenches	200	cy	30.00	4.00	$400.00	$1,600.00
Off-haul trench spoils	70	cy	7.00	1.00	$400.00	$400
Subtotal Equipment Costs						**$12,500.00**

*Note: Equipment Unit Costs includes sales tax and delivery as applicable.

Total Costs Including Mark-ups

Subtotal Labor Costs		$70,176.79
Subtotal Material Costs		$72,656.26
Subtotal Equipment Costs		$12,500.00
Direct Cost Subtotal		**$155,333.05**
General Conditions & Overhead	10.00%	$15,533.31
General Liability Insurance	0.25%	$427.17
Worker's Compensation Insurance	0.15%	$256.94
Payment and Performance Bond	1.50%	Not Required
General Contractor Fee	8.00%	$13,724.04
Total Cost of Work		**$185,274.50**

Section 10 Terminology and Glossary

1. Weather stations: compact sensor that monitors wind, rain, freezing temperatures, and shuts the irrigation system off as weather conditions require
2. Crew rate: the average direct labor cost of a group of tradesmen who execute a specific construction activity in an eight hour day.
3. Production rate: the average direct labor hours required to install a unit of material by a specified crew, based on an eight hour work day

Section 11 References

LEED- U.S. Green Building Council website: http://www.usgbc.org

Section 12 Copyright Releases

Not required for this technical paper.