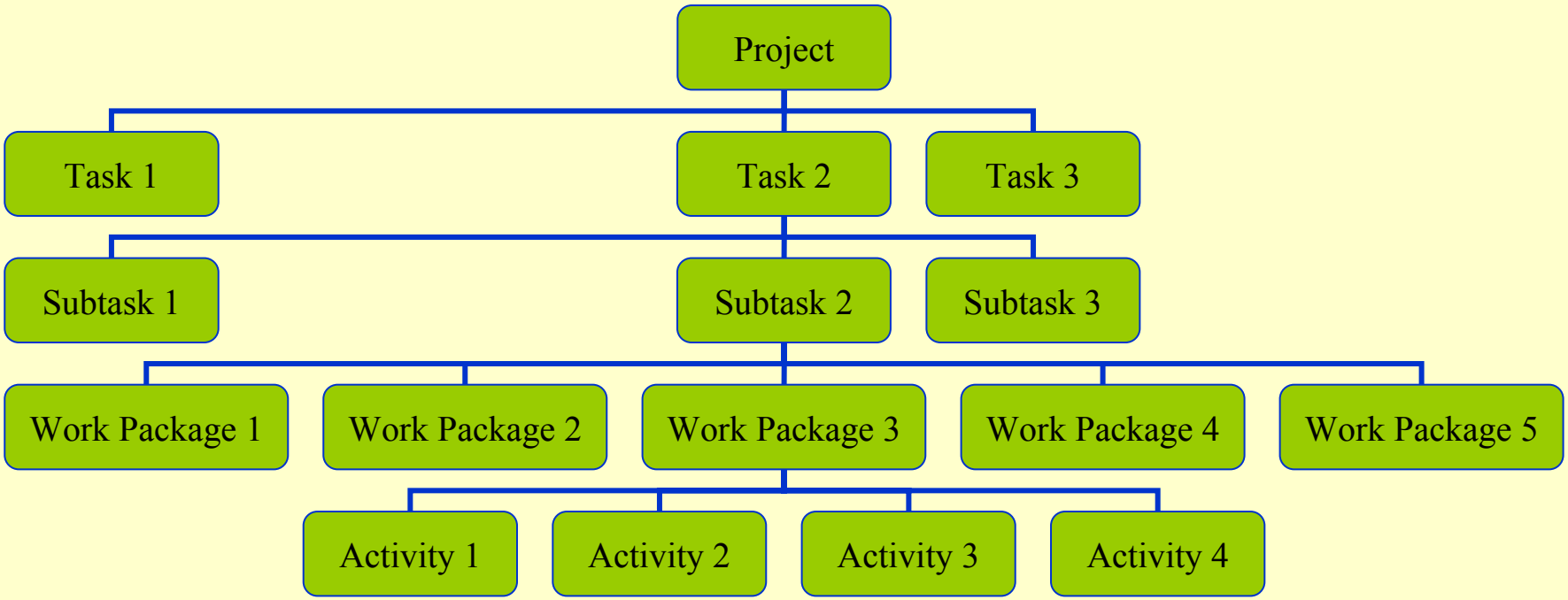
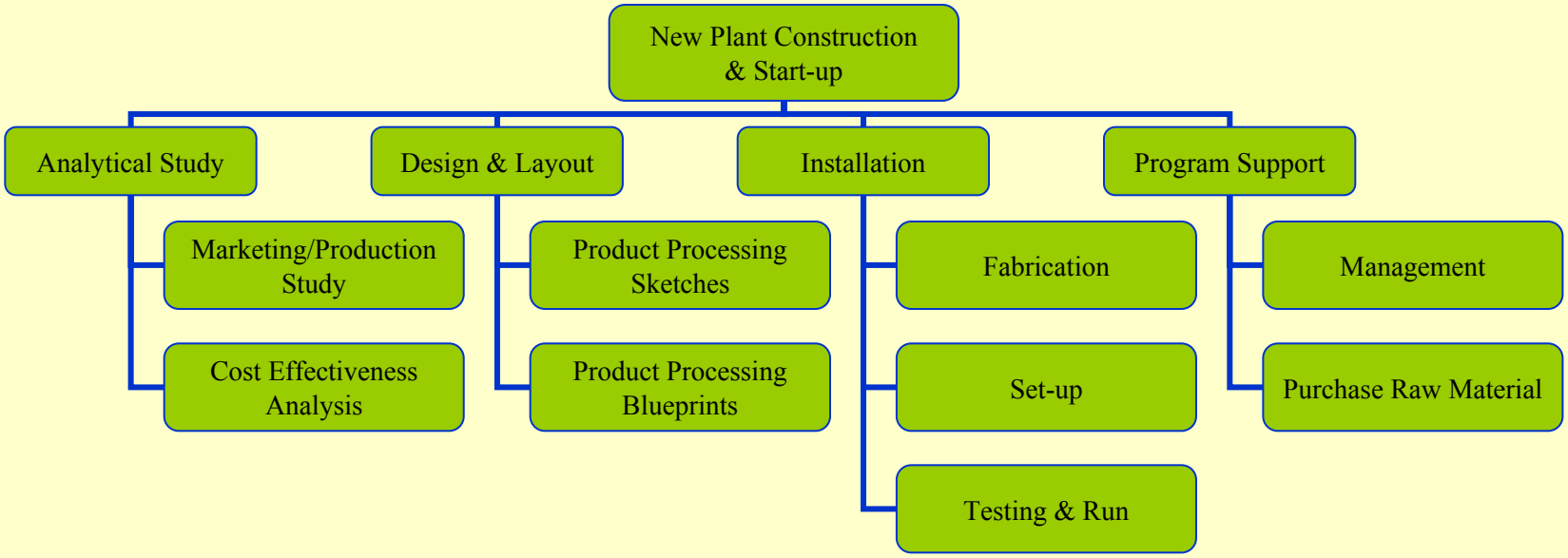
Work Breakdown Structure (WBS)

- A method to organize the project *total scope* of work in a hierarchical structure where each level represents an increased detail of the level above it.
- The items at the lowest level in a WBS are referred to as Work Packages
- Work packages may be further decomposed into work activities.
- The WBS is used to help in project planning and control as well as to develop a common understanding of the scope of the project

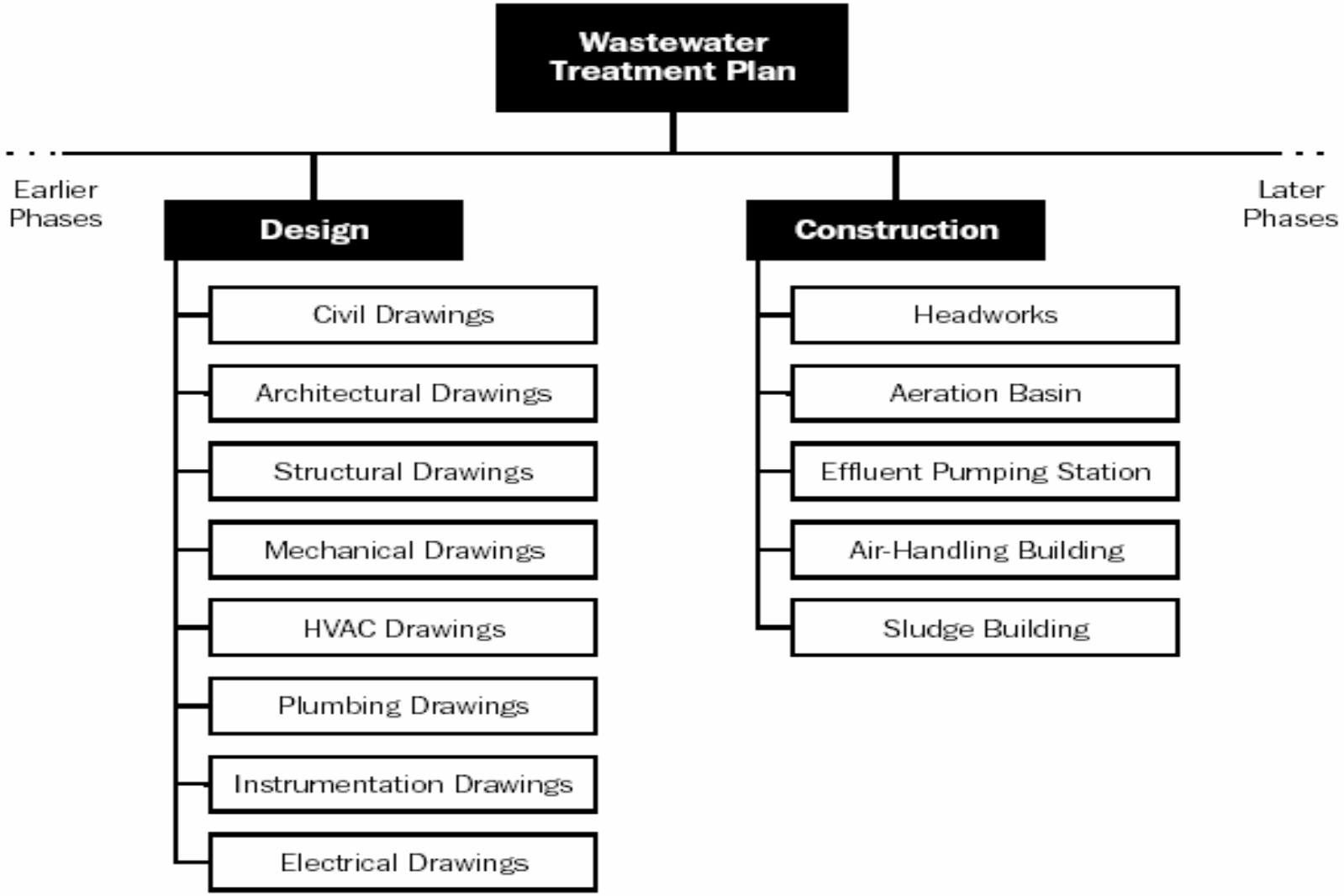
Project Work Breakdown Structure



Work Breakdown Structure
New Plant Construction & Start-up



Sample WBS for Wastewater Treatment Plant



- Source: PMI PMBOK 2000

Criteria for WBS

- The major components should indicate the deliverables of the project
- Lower level components should be measurable to allow scheduling, budgeting, and evaluating progress
- Breakdown must allow assignment of responsibility for work items

Activity Definition

- An activity is a unique unit of the project which can be described within prescribed limits of time.
- It can be a task, function, or decision that consumes time. It may or may not require any resource.
- Dummy activities do not consume time, but can be incorporated in the definition by allowing zero time durations.

Single Relationship

- We can apply network planning at any level of the WBS. Relationships at the upper levels of WBS are interdependent. At the lower levels they become simpler and less ambiguous.
- Only one relationship will be allowed between activities. An activity can only start after the completion of all preceding activities and all successor activities can only start after the completion of the activity.

Types of Activities

- Production Activities.
  Activities that contribute to the physical completion of the project.
- Procurement Activities.
  - Procurement of Resources (material, labor, equipment, capital)
  - Obtaining Permits and licenses
  - Engineering approvals and inspection
- Management Decision Activities.
  Management decisions that impact the Project schedule

Which activities to include?

- All Production Activities
- Procurement and Management Decision activities should be included if they constitute a constraint on Production activities.

Schedule Level of Detail

- Depends on Intended purpose of schedule
  - Who will use it?
  - What are the needs of the user?
  - What span of control is required?
- Upper levels in the organizational structure require lesser detail.
- Several schedules may need to be prepared.

Guidelines for Establishing Activities

- No rules. Only guides.
- Job Classification. (Masonry, Plumbing…)
- Project element (Pour Foundation, Construct footing)
- Combination of the two.
- Responsibility (Subcontracts)
- Other: Location, Equipment, Quantity)

Project: Remodeling of Chemical Lab

- Remove outdated equipment
- Place new benches
- Install base and wall cabinets
- Provide water, electrical, pressure air, and gas services
- Remove old fume hood and replace by a new one
- Install chemical sink
- Repair and paint floor, walls, and ceiling

Initial Activity List

	Activity Description
1	Strip Room
2	Repair Walls & Ceilings
3	Repair Floor
4	Lay Vinyl Floor
5	Rough-in Plumbing & Electrical
6	Finish Plumbing & Electrical
7	Replace Existing Fume Duct
8	Install New Fume Hood
9	Install Cabinets
10	Install Wall Cabinets
11	Install Chemical Sink
12	Paint Cabinet
13	Paint Walls & Ceiling

Initial Activities Plus Procurement activities for material and labor

	Activity Description
1	Strip Room
2	Repair Walls & Ceilings
3	Repair Floor
4	Lay Vinyl Floor
5	Rough-in Plumbing & Electrical
6	Finish Plumbing & Electrical
7	Replace Existing Fume Duct
8	Install New Fume Hood
9	Install Base Cabinets
10	Install Wall Cabinets
11	Install Chemical Sink
12	Paint Cabinets
13	Paint Walls & Ceiling
14	Obtain Vinyl Floor Covering
15	Obtain Cabinets
16	Obtain Fume Hood
17	Obtain Chemical Sink
18	Painter Availability

Activity List with Dependency

	Activity Description	Depends on	Depends on
1	Strip Room	-	
2	Repair Walls & Ceilings	1,5,7	5,7
3	Repair Floor	1,5	5
4	Lay Vinyl Floor	3,12,13,14	12,13,14
5	Rough-in Plumbing & Electrical	1	1
6	Finish Plumbing & Electrical	2,3,5,9,10,11,19	10,11,19
7	Replace Existing Fume Duct	1	1
8	Install New Fume Hood	2,3,16	2,3,16
9	Install 1/3 Base Cabinet	2,3,8,15	8,15
10	Install Wall Cabinets	2,3,7,15	2,3,15
11	Install Chemical Sink	2,3,5,9,17	9,17
12	Paint Cabinet	6,8,9,10, 11,18	6,18
13	Paint Walls & Ceiling	2,3,6,8,9,10,18	18
14	Obtain Vinyl Floor Covering	-	-
15	Obtain Cabinets	-	-
16	Obtain Fume Hood	-	-
17	Obtain Chemical Sink	-	-
18	Painter Availability	-	-
19	Install 2/3 Base Cabinet	2,3,9,15	9

Assumption of Unlimited Resources

- At the stage of developing the network no resource constraints should be placed on activities.
- Resource availability, sufficiency, and priority of assignment is addressed at later stage