Table 5–15
Types of gravitational phenomena utilized in wastewater treatment

Type of separation phenomenon	Description	Application/occurrence
Discrete particle settling	Refers to the settling of particles in a suspension of low solids concentration by gravity in a constant acceleration field. Particles settle as individual entities, and there is no significant interaction with neighboring particles	Removal of grit and sand particles from wastewater
Flocculent settling	Refers to a rather dilute suspension of particles that coalesce, or flocculate, during the settling operation. By coalescing, the particles increase in mass and settle at a faster rate	Removal of a portion of the TSS in untreated wastewater in primary settling facilities, and in upper portions of secondary settling facilities. Also removes chemical floc in settling tanks
Ballasted flocculent settling	Refers to the addition of an inert ballasting agent and a polymer to a partially flocculated suspension to promote rapid settling and improved solids reduction. A portion of the recovered ballasting agent is recycled to the process	Removal of a portion of the TSS in untreated wastewater, wastewater from combined systems, and industrial wastewater. Also reduces BOD and phosphorus
Hindered settling (also called zone settling)	Refers to suspensions of intermediate concentration, in which interparticle forces are sufficient to hinder the settling of neighboring particles. The particles tend to remain in fixed positions with respect to each other, and the mass of particles settles as a unit. A solids-liquid interface develops at the top of the settling mass	Occurs in secondary settling facilities used in conjunction with biological treatment facilities
Compression settling	Refers to settling in which the particles are of such concentration that a structure is formed, and further settling can occur only by compression of the structure. Compression takes place from the weight of the particles, which are constantly being added to the structure by sedimentation from the supernatant liquid	Usually occurs in the lower layers of a deep solids or biosolids mass, such as in the bottom of deep secondary settling facilities and in solids-thickening facilities
Accelerated gravity settling	Removal of particles in suspension by gravity settling in an acceleration field	Removal of grit and sand particles from wastewater
Flotation	Removal of particles in suspension that are lighter than water by air or gas flotation	Removal of greases and oils, light material that floats, thickening of solids suspensions

Description

Sedimentation is used for the removal of grit, TSS in primary settling basins, biological floc removal in the activated-sludge settling basin, and chemical floc removal when the chemical coagulation process is used. Sedimentation is also used for solids concentration in sludge thickeners. In most cases, the primary purpose is to produce a clarified effluent, but it is also necessary to produce sludge with a solids concentration that can be handled and treated easily.